CREEK COUNTY

Multi-Jurisdictional Multi-Hazard Mitigation Plan Update

Participation Jurisdictions:

Creek County
City of Bristow
Town of Depew
City of Drumright
Town of Kellyville
Town of Kiefer
City of Mannford
Town of Mounds
Allen Bowden Public Schools
Bristow Public Schools
Depew Public Schools
Drumright Public Schools
Gypsy Public Schools
Kellyville Public Schools
Kiefer Public Schools
Mannford Public Schools
Milfay Public Schools
Mounds Public Schools
Oilton Public Schools
Olive Public Schools
Pretty Water Public Schools

March 29, 2012

Chapter 1: Introduction

1.1 About the Plan

This document is the first phase of a multi-hazard mitigation plan for Creek County. It is a strategic planning guide developed in fulfillment of the Hazard Mitigation Grant Program requirements of the Federal Emergency Management Agency (FEMA), according to the Stafford Disaster Relief and Emergency Assistance Act. This act provides federal assistance to state and local governments to alleviate suffering and damage from disasters. It broadens existing relief programs to encourage disaster preparedness plans and programs, coordination and responsiveness, insurance coverage, and hazard mitigation measures.

This plan is developed in accordance with guidance from, and fulfills requirements for the Hazard Mitigation Grant Program (HMGP). The plan addresses natural hazards and hazardous materials events.

1.1.1 Purpose

The purpose of this plan is to:

1. Assess the ongoing hazard mitigation activities in Creek County (Chapter 1)
2. Outline the Planning Process used by Creek County in completing a Multi-Hazard Mitigation Plan (Chapter 2)
3. Identify and assess the hazards that may pose a threat to citizens and property (Chapter 3)
4. Evaluate mitigation measures that should be undertaken to protect citizens and property (Chapter 4)
5. Outline a strategy for implementation of mitigation projects (Chapter 5)
6. Plan Maintenance and Adoption (Chapter 6)

The objective of this plan is to provide guidance for county-wide hazard mitigation activities for the next five years. It will ensure that Creek County and other partners implement activities that are most effective and appropriate for mitigating natural hazards and hazardous materials incidents.

1.1.2 Scope

The scope of the Creek County Multi-Hazard Mitigation Plan is county-wide. It addresses natural hazards deemed to be a threat to the citizens of Creek County, as well as hazardous-materials events. Both short-term and long-term hazard mitigation opportunities are addressed beyond existing federal, state, and local funding programs. The jurisdictions participating in this

plan are Creek County, and the Creek County communities of Bristow, Depew, Drumright, Kellyville, Kiefer, Mannford, and Mounds. Also participating in this plan are school districts in Creek County; the school districts of Allen Bowden Public Schools, Bristow Public Schools, Depew Public Schools, Drumright Public Schools, Gypsy Public Schools, Kellyville Public Schools, Kiefer Public Schools, Mannford Public Schools, Milfay Public Schools, Mounds Public Schools, Oilton Public Schools, Olive Public Schools, and Pretty Water Public Schools.

1.1.3 Authority

Section 409 of the *Robert T. Stafford Disaster Relief and Emergency Assistance Act,* (Public Law 93-288, as amended), Title 44 CFR, as amended by Section 102 of the *Disaster Mitigation Act of 2000,* provides the framework for state and local governments to evaluate and mitigate all hazards as a condition of receiving federal disaster assistance. A major requirement of the law is the development of a hazard mitigation plan.

1.1.4 Funding

Funding for the Creek County Multi-Hazard Mitigation Plan was provided by a grant from the Federal Emergency Management Agency (FEMA) and the Oklahoma Department of Emergency Management (ODEM). A 75% FEMA grant through the ODEM, with a 25% local share, was administered through the Indian Nations Council of Governments (INCOG). The Hazard Mitigation Grant Program grant under FEMA 1876-DR-OK was $93,988.00. The local match was $31,330.00.

1.1.5 Goals

The goals for the Creek County Multi-Hazard Mitigation Plan were developed by Creek County staff and the Creek County Emergency Management Advisory Committee (CCEMAC), with input from adjacent jurisdictions, agencies, and interested citizens. The local goals were developed taking into account the hazard mitigation strategies and goals of the federal and state governments.

National Mitigation Strategy and Goal

FEMA has developed ten fundamental principles for the nation's mitigation strategy:

1. Risk reduction measures ensure long-term economic success for the community as a whole, rather than short-term benefits for special interests.
2. Risk reduction measures for one natural hazard must be compatible with risk reduction measures for other natural hazards.
3. Risk reduction measures must be evaluated to achieve the best mix for a given location.
4. Risk reduction measures for natural hazards must be compatible with risk reduction measures for technological hazards, and vice versa.
5. All mitigation is local.
6. Emphasizing proactive mitigation before emergency response can reduce disaster costs and the impacts of natural hazards. Both pre-disaster (preventive) and post-disaster (corrective) mitigation is needed.
7. Hazard identification and risk assessment are the cornerstones of mitigation.

8. Building new federal-state-local partnerships and public-private partnerships is the most effective means of implementing measures to reduce the impacts of natural hazards.
9. Those who knowingly choose to assume greater risk must accept responsibility for that choice.
10 Risk reduction measures for natural hazards must be compatible with the protection of natural and cultural resources.

FEMA's goal is to:

1. Substantially increase public awareness of natural hazard risk so that the public insists on having safer communities in which to live and work
2. Significantly reduce the risk of loss of life, injuries, economic costs, and destruction of natural and cultural resources that result from natural hazards

State of Oklahoma Mitigation Strategy and Goals

The State of Oklahoma has developed a Strategic All-Hazards Mitigation Plan to guide all levels of government, business, and the public to reduce or eliminate the effects of natural, technological, and man-made disasters. The goals and objectives are:

1. Improve government recovery capability.
2. Provide pre- and post-disaster recovery guidance.
3. Protect public health and safety.
4. Reduce losses and damage to property and infrastructure.
5. Preserve natural and cultural resources in vulnerable areas.
6. Preserve the environment.
7. Focus only on those mitigation measures that are cost-effective and provide the best benefit to communities.

The key measures to implement these goals include:

1. Enhance communication between state and federal agencies and local governments to facilitate post-disaster recovery and pre- and post-disaster mitigation.
2. Coordinate federal, state, local, and private resources to enhance the preparedness and mitigation process.
3. Ensure consistency between federal and state regulations.
4. Protect critical facilities from hazards.
5. Support legislation that protects hazardous areas from being developed.

Creek County's Goal

To improve the safety and well-being of the citizens residing and working in Creek County by reducing the potential of death, injury, property damage, environmental and other losses from natural and technological hazards

Goals for mitigation of each of the hazards are presented in Chapter 4

1.1.6 Point of Contact

The primary point of contact for information regarding this plan is:

Roscoe Thornbury
Creek County Emergency Management Director
10 S Oak
Sapulpa, OK 74066
Telephone: (918) 227-6358
Fax: (918) 227-6361
e-mail: roc3co@aol.com

The secondary point of contact is:

Irving Frank
Creek County Planning
317 E Lee Ave
Sapulpa, OK 74066
Telephone: (918) 227-6369
Fax: (918) 227-6308
e-mail:countyplanner@swbell.net

1.2 Community Description

Like most counties in the region, Creek County is faced with a variety of hazards, both natural and man-made. In recent history, winter storms, lightning, floods, and tornadoes have made the national headlines. Any part of the county may be impacted by high winds, drought, hail, fire, hazardous materials events, and other catastrophes. In some cases such as flooding and dam failure, the areas most at risk have been mapped and delineated.

Creek County is located south of the Arkansas River in the eastern part of the State of Oklahoma.

1.2.1 Geography

Latitude:	35.52N
Longitude:	96.22W

Creek County is located in northeast Oklahoma and is accessed primarily by I-44, US-66, SH-33, SH -48, and SH- 97. Sapulpa, the county seat of Creek County, is 22 miles southeast of Tulsa and 94 miles northeast of Oklahoma City. Creek County encompasses approximately 970 square miles. Map Number 1 in Appendix 1 is a location map of Creek County.

1.2.2 Climate

Sapulpa the county seat of Creek County lies at an elevation of 818 feet above sea level. Creek County is far enough south to miss the extreme cold of winter. The climate is essentially continental characterized by rapid changes in temperature. The winter months are usually mild, with temperatures occasionally falling below zero, but only for a very short time. Temperatures of 100 degrees or higher are often experienced from late July to early September. January's average temperature is 23 degrees Fahrenheit and Augusts' average high temperature is 93 degrees Fahrenheit. Creek County will receive a wide variety of precipitation throughout any given year. It averages 39.85 inches of rainfall.

1.2.3 History

Creek County was created at statehood, in 1907. The county was intended to be named Moman County in honor of the mother of Moman Pruiett. The name was changed at the last moment at the Constitutional Convention, thus the reason that in the alphabetical list of counties in the State Constitution, Creek County appears following Mayes County. The County was named for the Creek Nation; the word is from the term "Ochese Creek Indians," used by the early British settlers.

1.2.4 Population and Demographics

According to the 2010 US Census, the2010 Creek County population was 69,967. In 2000, the County population was 67,367, an increase of 3.86% over the ten years; making an annual growth rate of 0.38%. The median age of the Creek County population is 40.0, with 15% of the population being 65 or greater, according to the U.S. Bureau of the Census. Older populations are more vulnerable to certain hazards, such as extreme heat and cold. A map, showing the age 65 and older areas, is shown in Map Number 2 in Appendix 1. Low-income populations are also

more vulnerable to extreme temperatures; low-income areas are shown in Map Number 3 in Appendix 1. Creek County demographic data is shown in Table 1-1.

Table 1-1: Creek County Demographic Data
Source: 2010 Census

SUBJECT	NUMBER
Total Population	69,967
65 years and older	10,475
Poverty Status in 2009 (individuals)	8,953

According to the Creek County Assessor's Office 2011 records, there are 43,005 parcels in the County, and 24,816 parcels with improvements, with an assessed improvement value of $1,757,048,808. Numbers of parcels with improvements (buildings, garages, pools, storage, etc.) and improvement values, by type are shown in the table below.

Table 1-2: Creek County Housing Property Types by Assessed Values
Source: Creek County Assessor's Office

Category	Number of Structures	Structure Value ($$)
Residential	20,694	1,289,255,092
Commercial	1,384	309,410,433
Agricultural	2,738	158,383,283
Total	24,816	1,757,048,808

1.2.5 Local Utilities--Lifelines

Lifelines are defined as those infrastructure facilities that are essential to the function of the community and the well being of its residents. They generally include transportation and utility systems. Transportation systems include interstate, US, and state highways, rail, waterways, ports and harbors, and airports. Utility systems include electric power, gas and liquid fuels, telecommunications, water, and wastewater. The following table shows utilities and the companies or sources that supply each one for Creek County.

Table 1-3: Utility Suppliers for Creek County

UTILITY	SUPPLIER
Electric	Community and AEP/PSO
Water	Community and RWD
Sewage Treatment	Community
Natural Gas	Community, ONG, and OG&E
Telephone	Southwestern Bell

1.2.6 Economy

According to the 2010 U.S. Census, Creek County's population age 16 and over was 54,658. In 2000, there are 30,034 people in the labor force and 2.9% are unemployed. Of the people employed, 79.5% are salary and private-wage workers, 13.2% are government workers, and 7.1% are self-employed in unincorporated businesses. The median household income in 2000 was $33,168.

1.2.7 Industry

Principle employment occupations in Creek County include managerial, professional, sales, and office work, followed by production, transportation, service occupations, and construction, maintenance.

1.2.8 Future Development

The Tulsa Metropolitan Statistical Area is growing at 1.3%, the same as the national growth rate. Comparatively, the State of Oklahoma is growing at 1.0% annually. Creek County's annual growth rate is 0.38%. Growth, development and redevelopment in Creek County are estimated to continue at this same pace. Primary growth areas include the Sapulpa area and the northeast corner of the County near Tulsa.

Growth Trends

Oklahoma Department of Commerce estimates that Creek County will continue to grow at .038% per year over the next twenty years. Development activity is expected to continue in the Sapulpa Area and the northeast corner of the County.

1.3 Regulatory Framework

This section contains a summary of the current ordinances for land use, zoning, subdivision, floodplain in Creek County that was reviewed by the Creek County Multi-Hazard Planning Committee. It also lists the current building codes and fire insurance rating.

1.3.1 Comprehensive Planning and Zoning

Creek County has a comprehensive plan, zoning code, and subdivision regulations. The Creek County Planning Commission oversees planning and zoning in Creek County. The Zoning Code and Subdivision Regulations, and input by the County Planning and Zoning staff, were utilized as a reference in the development of this Hazard Mitigation Plan.

Creek County Zoning Code, adopted March 1, 1994, is administered by County staff.

Creek County Subdivision Regulations, adopted October 10 1988, is administered by the Creek County Planning Commission pursuant to the powers vested through Title 19, Oklahoma Statutes, Chapter 19.a, Sections 12 and 13, as amended to review, approve and disapprove plats for the subdivision of land within the Creek County.

Bristow Zoning Code, adopted 1977, is administered by the City.
Bristow Subdivision Regulations, adopted 1977, is administered by the City.

Drumright Zoning Code, adopted 1983, is administered by the City.
Drumright Subdivision Regulations, adopted 1977, is administered by the City.

Kiefer Zoning Code, adopted 2011, is administered by the Town.
Kiefer Subdivision Regulations, adopted 2011, is administered by the Town.

1.3.2 Floodplain Management

The Creek County participates in the National Flood Insurance Program (NFIP). The County enforces floodplain management regulations beyond the national minimum criteria. The County's floodplain management regulations and mapping were utilized as a resource and reference in the development of this Hazard Mitigation Plan. The other communities participating in the plan; Bristow, Depew, Drumright, Kellyville, Kiefer, Mannford, and Mounds, also participate in the NFIP.

1.3.3 Building Codes

The Creek County and the participating communities use the International Building Code, published by BOCA, as well as supplemental ordinances which cover areas where the International Codes are inadequate or vague. This information was used as a reference in preparing this Hazard Mitigation Plan.

1.3.4 Fire Protection and Insurance

Creek County has numerous community fire departments, with various ISO fire ratings. Ratings for the participating communities in Creek County range from 4 to 9, where lower numbers

signify better ratings. Primary factors related to the rating process involves how the department responds to alarms and notifies its personnel; the supply and distribution of water in the area; staffing; training and equipment. ISO ratings for the participating communities' fire departments in the county are as follows: Bristow - 5, Depew - 5, Drumright - 6, Kellyville - 5, and Kiefer - 5. Fire Department statistics and information were used as a reference in preparing this Hazard Mitigation Plan and are discussed in more detail in Chapter 3: Wildfires.

1.4 Existing Hazard Mitigation Programs

In an effort to address hazards that impact the county, the Creek County has identified existing plans and procedures for informing people about protection measures and warning the public of impending threats. The review of existing plans is important in the preparation of this hazard mitigation plan.

1.4.1 Emergency Operations Plans

The Creek County has adopted an Emergency Operations Plan (EOP) in 2011. The EOP was used as a reference in preparing this Hazard Mitigation Plan

Bristow has adopted an Emergency Operations Plan, last adopted in 2007.
Drumright has adopted an Emergency Operations Plan, adopted in 2003.
Kiefer has adopted an Emergency Operations Plan, adopted in 2011.
Oilton has adopted an Emergency Operations Plan, last updated in 2011.

Drumright Public Schools has adopted an Emergency Operations Plan, last updated in 2011.
Mounds Public Schools does not have an Emergency Operations Plan.

1.4.2 Capital Improvement Plan

The Capital Improvement Plan (CIP) is the principle method of scheduling and financing future capital needs, and part of those needs could address hazard mitigation actions. Major updates to the CIP should occur periodically and the plan should receive a minor review during the annual budgeting process. All eight of the participating communities have CIPs, and projects on their CIPs could have a positive impact upon the community's ability to mitigate and respond to hazard events.

The City of Bristow last updated their CIP in 2010. Their capital projects included:

1. Street Improvements
2. Sewer Line Improvements
3. Water Line Improvements
4. Acquire a skid steer

The City of Drumright last updated their CIP in 2010. Their capital projects included:

1. Replace Bullet Proof Vests
2. Replace Policed Patrol Vehicle
3. Renovate/Replace Police Building
4. Replace Storm Sirens

The Town of Kellyville last updated their CIP in 2010. Their capital projects included:

1. Sewer Line Improvements
2. Lagoon Improvements
3. Improve Roads in the Cemetery
4. Replace Sewer Machine

The Town of Kiefer last updated their CIP in 2009. Their capital projects included:

1. Remodel Police Station
2. Resurface N. Mary Street

3. Street Repairs in multiple locations
4. Update wastewater lagoon

The City of Oilton last updated their CIP in 2005. The capital needs included:

1. Street Improvements
2. Waterline Improvements
3. Sewer line Improvements
4. Repairs to City Hall

The School Districts also have capital improvement plans, in the same manner and purposes as the communities.

The Allen Bowden Public Schools has a capital improvement plan, updated in 2009. Their capital projects for FY2013 include:

1. Replace the flooring in 6-8 Building.
2. Construct a new track.
3. Paint the PreK-3 Building. Inside.

The Bristow Public Schools CIP was lasted updated in 2011. Their capital projects include:

1. Construction and equipping a Kindergarten building
2. All weather track resurfacing project
3. Construction of an Agriculture Program classroom/Wrestling room addition
4. Installation of in ground irrigation systems at the Softball/Baseball complex
5. Upgrade/Modernization of all library computer systems
6. Construction of a Pecan St. egress at the high school site
7. Installation of a new Press box at Hafer Field (football/track facility)
8. Acquire and install technology equipment at all sites (wireless capabilities)
9. Construction of covered walkways in designated areas at all school sites.

The Drumright Public Schools CIP was lasted updated in2009. Their capital projects include:

1. A new middle school.
2. New athletic fields.
3. Technology improvements.

The Mounds Public Schools does not have a capital improvement plan.

The Pretty Water Public Schools has a capital improvement plan. Their capital projects include:

1. Eight HVAC units.
2. Remodel two elementary school restrooms.

Chapter 2:

The Planning Process

2.1 Documentation of the Planning Process

The Creek County Multi-Hazard Mitigation Plan is a county-wide effort to coordinate Creek County's multi-hazard planning, development, and mitigation activities. The Indian Nations Council of Governments (INCOG) was responsible for overall coordination and management of the study, aided by Creek County staff and representatives of the participating jurisdictions.

A mitigation plan is the product of a rational thought process that reviews the hazards, quantifies their impacts on the county, identifies alternative mitigation activities, and selects those activities that will work best for the county.

This plan addresses the following hazards

- Floods
- Tornadoes
- High Winds
- Lightning
- Hailstorms
- Severe Winter Storms
- Extreme Heat
- Drought
- Expansive Soils
- Wildfires
- Earthquakes
- Hazardous Materials Events
- Dam Breaks

The approach for the Creek County multi-hazard mitigation plan update followed a ten-step process, based on the guidance and requirements of FEMA. The ten steps are described below.

2.1.1 Step One: Organize to Prepare the Plan

An open public process was established to give all sections in Creek County and individuals and agencies in the County regional area interested in hazard mitigation issues, an opportunity to become involved in the planning process and make their views known. Citizens and community leaders; city, county, regional, state, and federal staff; and professionals active in hazard mitigation planning provided important input in the development of the plan.

The planning process was conducted by the Creek County Emergency Management Advisory Committee (CCEMAC), made of representatives of the participating jurisdictions.

The CCEMAC was supported by the county staff. INCOG staff worked with the committee for this hazard mitigation plan update. The County and INCOG staff met several times during the planning process; attended all meetings of the CCEMAC and meetings with elected officials. All of the CCEMAC meetings were posted at the County and in other public places, including the County Emergency Management Office, and open to the public.

The CCEMAC met at the Creek County Assessor's Offices during the planning process to review progress, identify issues, receive task assignments, and advise the County and INCOG staff dedicated to updating the plan. Local research and input was provided by committee members and the INCOG staff provided a regional hazard mitigation perspective and direct access to state and federal hazard information resources and led the preparation of draft planning documents. INCOG staff outlined the plan and prepared a draft. Committee members selected the hazards to investigate, provided specific county information, conducted the public hazard awareness survey, ranked mitigation activities, and selected the action plan projects. INCOG staff then prepared the final plan update for review. A list of CCEMAC members and meetings are shown in Table 2-1. The agendas, minutes, and sign-in sheets for these meetings are included in Appendix 2.

Table 2–1:
Creek County Emergency Management Advisory Committee

Roscoe Thornbury	Creek County, Emergency Mgmt Dir, and Committee Chairman
Irving Frank	Creek County
Bob Grant	City of Bristow
Danny Cooper	City of Drumright
Roger Tuttle	Town of Kellyville
Stacey White	Town of Kiefer
Bruce Coldiron	City of Oilton
Jimmy Reynolds	Allen Bowden Public Schools
Curtis Shelton	Bristow Public Schools
Joe Crowder	Drumright Public Schools
Ike M^{C}Daniel	Mannford Public Schools
Alfred Gaches	Mounds Public Schools
Jeff Taylor	Pretty Water Public Schools.
John M^{C}Elhenney	INCOG

Committee Meetings and Activities

Date	*Activity*
First meeting 11/17/2011	CCEMAC meeting at Creek County Assessor's Offices to discuss the overall need for a plan, the jurisdictions to be included in the update, the planning process and plan outline, discuss hazard identification and assessment issues and begin review of Draft Plan. Developed a hazard awareness survey.
Second meeting 01/12/2012	CCEMAC meeting at Creek County Assessor's Offices to review the hazard awareness survey, review the mapping, discuss mitigation goals and objectives, and discuss mitigation activities and the ranking process.
Third meeting 02/16/2012	CCEMAC meeting at Creek County Assessor's Offices to review committee's selection of mitigation activities for the County, the Communities, and the School Districts. Also discuss the plan maintenance and the County, Communities, and School Districts adoption process.
Fourth meeting 03/29/2012	CCEMAC meeting at Creek County Assessor's Offices to hold public hearing on final draft, receive comments from other communities and agencies, and Committee recommendation to approve plan.
April 2012	Creek County Board of County Commissioners Meeting. The Board will take action on adopting the updated multi-jurisdictional multi-hazard mitigation plan by resolution.

2.1.2 Step Two: Involve the Public

An open to the public planning process was again utilized by the County in this plan update process. In addition to the CCEMAC, the staff team undertook additional projects to inform the public of this effort and to solicit their input. All meetings of the CCEMAC were publicly posted. A hazard awareness survey was developed and circulated by CCEMAC members and by the County to solicit community input on hazard awareness and assessment of their level of concern. Feedback from these surveys was important to the development of the plan. 104 responses were received. A copy of the survey and summary of the responses are included in Appendix 4. Public comments were also invited through a public hearing. A public hearing was held on March 29, 2012 to solicit public comments before final plan update approval. A copy of the public hearing notice, attendance, and minutes are included in Appendix 2.

2.1.3 Step Three: Coordinate with Other Agencies and Organizations

As part of the plan update process and to collect data on the hazards that impact Creek County, staff reviewed information sources: public agencies, private organizations, and businesses that contend with natural hazards. These sources included printed documents and internet web sites. The agencies and organizations included FEMA, the Corps of Engineers, the US Geological Survey, INCOG, Creek County, the State Department of Environmental Quality, the National Climatic Data Center, the National Oceanic and Atmospheric Administration the Tulsa World, and the Natural Resource Conservation Service. Academia included the University of Oklahoma Meteorology Department. FEMA mapping, when combined with aerial data and historic data

from the National Climatic Data Center proved to be crucial to hazard identification and impact. The following list of agencies was invited to comment on a draft of the updated plan prior to approval. A sample letter requesting such comments is included in Appendix 3.

Federal

US Army Corps of Engineers
Natural Resource Conservation Service (NRCS)
US Fish and Wildlife Service

National Non-Profit

American Red Cross

State

Oklahoma Department of Civil Emergency Management
Oklahoma Water Resources Board
Oklahoma Conservation Commission
Oklahoma Department of Wildlife Conservation
Oklahoma Department of Environmental Quality

Regional

Indian Nation Council of Governments (INCOG)

Creek County

County Departments

Bristow, Depew, Drumright, Kellyville, Kiefer, Mannford, and Mounds

Municipal Offices

Business

John Brock, Sapulpa Herald

Academia

Allen Bowden Public Schools
Bristow Public Schools
Depew Public Schools
Drumright Public Schools
Gypsy Public Schools
Kellyville Public Schools
Kiefer Public Schools
Mannford Public Schools
Milfay Public Schools
Mounds Public Schools
Oilton Public Schools
Olive Public School
Pretty Water Public Schools.

Non-Profit

Richard Forbes

Coordination with other county planning efforts is critical to the success of the Multi-Hazard Mitigation Plan updates. The planning process utilized for the initial plan was followed for the 2012 update. The CCEMAC used information included in the most current version of the County's Comprehensive Plan, Emergency Operations Plan, FIRM Maps, Building Codes and County Ordinances as part of the update process. The County Staff provided information in regard to the utilization of the initial Multi-Hazard Mitigation Plan as a resource for integrating Action Plan Activities and other plan information into other County planning activities. Through

participation in the CCEMAC, participating communities and school districts provided valuable information to the plan update process.

2.1.4 Step Four: Assess the Hazard

The staff team collected data on the hazards from available sources. Hazard assessment is included in Chapter 3, with the discussion of each hazard.

Table 2-2 lists the various hazards that affects Creek County, describes how they were identified, and why they were identified.

Table 2–2:
How and Why Hazards Were Identified

Hazard	*How Identified*	*Why Identified*
Floods	• Review of FEMA and City and County floodplain maps • Buildings in the floodplains • Historical floods and damages	• 2711 parcels in Creek County are located in the floodplain • Over $ 200 million of property at risk
Tornados	• Review of recent disaster declarations • Input from Emergency Manager • Consensus of Emergency Management Advisory Committee • Review of data from the NCDC	• Creek County is located in "Tornado Alley" • An average of one tornado strikes Creek County annually. • All County is a risk.
High Winds	• National Weather Service data • Loss information provided by national insurance companies	• High wind-related events in occur in Creek County.
Lightning	• NCDC information and statistics	• Thunder and lightning occur regularly throughout the County.
Hailstorms	• National Climatic Data Center	• Anecdotal evidence suggests hail damage accounts for the highest residential insurance claims in the County.
Severe Winter Storms	• Review of past Disaster Declarations • Input from State Emergency Management Agency and Creek County Emergency Management • Input from area utility companies	• The County experienced a severe snow and ice event in 2011, bringing the County to a halt. • Severe snow and ice events seem to occur annually.
Extreme Heat	• Review of number of heat-related deaths and injuries during hot Oklahoma summers • Review of data from NCDC	• Local community service organizations have made heat- related deaths a high priority. • Extreme heat is extremely dangerous to the elderly and infirm.
Drought	• Historical vulnerability to drought, the "Dust Bowl" era • Drought and water shortages in adjacent communities in recent years	• Need to ensure adequate long- term water resources for the County
Expansive Soils	• Input from INCOG • Review of NRSC data	• Damage to buildings from expansive soils is difficult after it is built. • Can be mitigated with building code provisions.

Table 2–2: How and Why Hazards Were Identified (continued)

Hazard	*How Identified*	*Why Identified*
Wildfires	• Input from Creek County Fire Departments • Input from State Fire Marshal	• Continuing loss of life and property due to fires • Numerous areas of Creek County are exposed and vulnerable to wildfires
Earthquakes	• Historic records of area earthquakes • Input from Oklahoma Geological Survey • Input from USGS	• Creek County has had mild earthquakes
Dam Break	• OWRB Dam Safety Program • Review of USGS maps • Review of FIRM maps	• 13 dams in the county are identified as significant or high hazard dams. A dam break would flood buildings and facilities downstream
Hazardous Materials Events	• Input from ODEQ • Input from the State Fire Marshall	• Several hazardous materials sites are scattered throughout the county • Major traffic ways expose Creek County to potential traffic way hazardous materials incidents

2.1.5 Step Five: Assess the Problem

The hazard data was analyzed in light of what it means to public safety, health, buildings, transportation, infrastructure, critical facilities, and the economy. County and INCOG staff prepared several analyses using INCOG's geographic information system. The discussion of the problem assessment is addressed for each hazard in Chapter 3.

DAMAGE ESTIMATION METHODOLOGY

The following methodologies were used in the development of damage cost estimated for buildings and contents for flooding and tornado/high wind damage, used in Creek County's Multi-Hazard Mitigation Plan and Update.

Structure Value: The value of the buildings within Creek County was obtained from the Creek County Assessor's office.

Contents Value: Value of contents for all buildings was estimated using FEMA 386-2 *Understanding Your Risks*. Table, page 3-11, "Contents Value as Percentage of Building Replacement Value".

2.1.6 Step Six: Set Goals

Hazard mitigation goals and objectives for Creek County were developed by the CCEMAC to guide the development of the plan. The hazard mitigation goals and objectives for the County are listed in Chapter 4.

2.1.7 Step Seven: Review Possible Activities

A wide variety of measures that can affect hazards or the damage from hazards were examined. The mitigation activities were organized under the following six categories. A more detailed description of each category is located in "Chapter 4: Mitigation Strategies."

1. **Preventive activities**—Zoning, building codes, city ordinances
2. **Structural Projects**—Levees, reservoirs, channel improvements
3. **Property protection**—Acquisition, retrofitting, insurance
4. **Emergency service**—Warning, sandbagging, evacuation
5. **Public information and education—**Outreach projects and technical assistance

2.1.8 Step Eight: Draft an Action Plan

The County and the CCEMAC reviewed the list of recommended actions in the initial Creek County Multi-Hazard Mitigation Plan. The County reported to the committee the projects that were completed. Potential future hazard mitigation activities were reviewed and discussed by the committee. The County then selected mitigation projects and activities for the Count y to include in this update; for each project or activity identified for this update, it identified the party responsible for implementing the task, estimated the cost of the project, identified potential funding sources, and determined the target completion date for each activity. Each participating jurisdiction did the same for their own jurisdiction. Once all the jurisdiction's action plans were drafted, they were inserted into the final draft of the County multi-hazard mitigation plan update.

2.1.9 Step Nine: Adopt the Plan

The CCEMAC reviewed the final draft approved the final plan and submitted it to the Creek County Board of County Commissioners, and each jurisdiction's governing board, for adoption.

2.1.10 Step Ten: Implement, Evaluate, and Revise

Adoption of the Multi-Hazard Mitigation Plan is only the beginning of this effort. County offices, other agencies, and private partners will proceed with implementation. The CCEMAC will monitor progress, evaluate the activities, and annually recommend revisions to the action items. This process will involve quarterly meetings in which the CCEMAC will monitor progress on the Action Plan and review other mitigation actions for inclusion in the Action Plan for Years 2 through 5. This monitoring and review process will also be coordinated so as to provide input into other appropriate county and community planning efforts specifically updates to the County's Capital Improvement Plan and the County's Annual Budget.

Chapter 3:

Risk Assessment and Vulnerability Analysis

3.1 Identifying Hazards

There were 13 hazards investigated by the CCEMAC. These were considered to be all the relevant hazards, following the committee's hazard information search. Hazard identification was discussed at the initial hazard mitigation planning meetings, held on November 17, 2011.

The hazards facing the participating Creek County communities and the participating school districts are the same hazards facing the County. The participating communities' buildings, and the participating school districts' buildings, are all located within Creek County. Therefore, their risk and vulnerability from the hazards are included in the Creek County countywide risk and vulnerability analysis. A map showing the location of the schools' buildings being within Creek County is shown on Map 1A in Appendix 1.

The hazards are listed in Table 2.2. The table lists each hazard, the items that were considered in how the hazard was identified, and why each hazard was identified. Hazard information was obtained from the County Emergency Management, Community Officials, regional planning agency (INCOG), review of FIRMs, and public input.

3.2 Profiling Hazard Events

This section provides a profile of each hazard. In this section, the letter "X", when included in a subsection identification label, refers to a specific hazard's subsection, as follows:

X=1 Flood Hazard
X=2 Tornado Hazard
X=3 High Winds Hazard
X=4 Lightning Hazard
X=5 Hail Storm Hazard
X=6 Winter Storm Hazard
X=7 Heat Hazard
X=8 Drought Hazard
X=9 Expansive Soils Hazard
X=10 Wildfire Hazard
X=11 Earthquake Hazard
X=12 Hazardous Material Hazard
X=13 Dam Break

Subsection 3.2.X.1 describes each hazard, subsection 3.2.X.2 identifies the location of the hazard, subsection 3.2.X.3 identifies the extent (such as severity or magnitude) of the hazard, subsection 3.2.X.4 provides information on previous occurrences, subsection 3.2.X.5 discusses the probability of future occurrences, and subsection 3.2.X.6 discusses vulnerability and impact. Each hazard affects the county as a whole, except floods, expansive soil and dam breaks which are location specific.

3.2.1 Flood Hazard

3.2.1.1 Flooding is defined as the accumulation of water within a water body and the overflow of the excess water onto adjacent lands. The floodplains are the lands adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding.

3.2.1.2 The location of the flood hazard in Creek County is its regulatory floodplain, as defined by the County's Flood Insurance Rate Maps (FIRMs). The regulatory floodplain lies in several watersheds within the County. The flood hazard is shown on Map Number 5 in Appendix 1.

3.2.1.3 The severity of a flood is determined by several factors; including, rainfall intensity, duration, and location, and ground cover imperviousness and degree of saturation. The magnitude of the flood hazard is the regulatory floodplain. The regulatory floodplain is defined as the area inundated by the runoff from the rainfall having a one-percent chance of occurring in any given year. Although flooding is an identified hazard, the effects have been minimal except for a few locations in the County. The regulatory floodplain is identified in the County's Flood Insurance Rate Maps (FIRMs) as Zone A and Zone AE. The following chart describes the FIRM's flood zones.

Table 3-1

FLOOD ZONES		
Zone A	The 100-year or Base Floodplain. There are seven types of A zones:	
	A	The base floodplain mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A zone.
	A1-30	These are known as numbered A zones (e.g., A7 or A14). This is the base floodplain where the firm shows a BFE (old format).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFE's are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	**V**	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the FIRM.
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	
Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.	
Zone D	Area of undetermined but possible flood hazards.	

A typical flood hazard would be an event where rainfall causes runoff to exceed the creek channel capacity spilling runoff into the floodplain fringe, the area between the creek channel and the edge of the regulatory floodplain. This area of inundation would still be regulated by the County's (and each community's) Flood Damage Prevention Ordinance where new buildings are protected under the ordinance and older structures are addressed below in section 3.2.1.4. The worst case flood event would be where rainfall occurs causing runoff to exceed the regulatory floodplain, thereby inundating areas and possibly structures outside the areas regulated by the Flood Damage Prevention Ordinance, the ordinance adopted by Creek County and the communities as part of their participation in the National Flood Insurance Program. A proposed action plan will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.1.4 Historically, the County has recognized flooding as a hazard. The County joined the National Flood Insurance Program (NFIP) in 1987, adopting a Flood Damage Prevention Resolution, and requiring that all future development be built one foot above the 100-year base flood elevation. According to the National Climatic Data Center, from 1950 through 2010, Creek County has had 78 flood events, causing an estimated $10,780,000 in total damages. There are five repetitive loss structures in the Creek County that are insured through the National Flood Insurance Program.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.1.5 The probability of future flooding from the regulatory floodplain is statistically a one-percent chance of occurring in any given year, the 100-year floodplain. The County and participating communities require all new development to develop in compliance with their flood damage prevention ordinance. Therefore, new development will not cause an increase in the flood hazard by not increasing the hazard on to adjacent property and building new structures above the regulatory flood elevation; both provisions of the ordinance. So the probability of future flood damage should not increase with future development. According to the likelihood rating from Appendix 6, the likelihood of a flood hazard in the County is "highly likely".

3.2.1.6 Flooding can take many forms including river floods (riverine) and creeks and flash floods. The most likely event for serious flooding would be flash flooding due to storm water drainage backup caused by a large amount of rain from a thunderstorm. Flash floods occur with little or no warning and can reach peak flow within a few minutes. Waters from flash floods move with great force and velocity and can roll boulders, tear out trees, destroy buildings, and sweep away bridges. These walls of water can reach heights of 10 to 30 feet and generally carry large amounts of debris. Most flood deaths are due to flash floods.

The low-lying areas in the flood plains would be more susceptible to flooding. Roadways in the area are vulnerable and have a history of having to be closed during flooding events. This can cause what is usually temporary interruptions to the highway and road system and has the potential to isolate a community for a period of time. Water Wells, houses, utility lines and sewer systems are damaged by flood waters. This causes the citizens to be without power, homes and in many cases people must be relocated to other areas.

Table 3-2

CONTRIBUTING FACTORS TO THE FLOOD HAZARD	
Factor	**Effect**
Precipitation Rate	The most obvious contributing factor. As the rate of precipitation increases, so to does its ability to outpace the ability of the watershed to absorb it. This is the dominant factor in flash flooding events, and can overwhelm any or all of the following factors.
Training Echoes	Storm cells that follow each other (much like box cars on a train) can repeatedly deposit large amounts of water on the same watershed, overwhelming its ability to handle runoff.
Slope of Watershed	Steeper topography (hills, canyons, etc.) will move runoff into waterways more quickly, resulting in a quicker, flashier response to precipitation.
Shape of Watershed	Longer, narrower watersheds will tend to "meter out" runoff so that water arrives from down shed (nearer to the mouth of the stream) areas faster than from up shed areas. In watersheds that are more square or circular than elongated, runoff tends to arrive in the main stem at the same time, intensifying the response. This factor becomes more significant with larger watersheds.
Saturation of Soils	Saturated or near-saturated soils can greatly reduce the rate at which water can soak into the ground. This can increase runoff dramatically.
Hardened Soils	Extremely dry soils can develop a pavement or "crust" that can be resistant to infiltration. This is especially true in areas of recent wildfire, where plant oils or resins may cause the soil to be even more water-resistant.
Urbanization	The urban environment usually intensifies the response to heavy precipitation. The two dominant urban factors are: 1) increased pavement coverage, which prevents infiltration and dramatically increases runoff; and 2) Urban systems are designed to remove water from streets and byways as quickly as possible. This accelerates the natural response to precipitation by placing runoff in waterways much more quickly.
Low-water crossings	The vast majority of flash flood related deaths occur in vehicles. Many of these deaths occur at low-water crossings where the driver is unaware of the depth of the water or the consequences of driving into it.

It is estimated that 11 % of the improved property (2711 parcels) in the County are located in the 100 year floodplain. It is unknown the number of people that reside in these residences; these structures are valued at $240 million dollars.

3.2.2 Tornado Hazard

3.2.2.1 A tornado is a rapidly rotating vortex or funnel of air extending to the ground from a cumulonimbus cloud. When the lower tip of a vortex touches earth, the tornado becomes a force of destruction. The path width of a tornado is generally less than a half-mile, but the path length can vary from a few hundred yards to dozens of miles. A tornado moves at speeds from 30 to 125 mph, but can generate winds exceeding 300 mph.

3.2.2.2 Creek County is located west of Tulsa, Oklahoma. The following figure obtained from the FEMA web site shows central Oklahoma, along with the area around Fort Worth Texas, to be the area of highest number of recorded tornados per area in the country. Within Creek County, no area of the County is any more or less at risk from the tornado hazard.

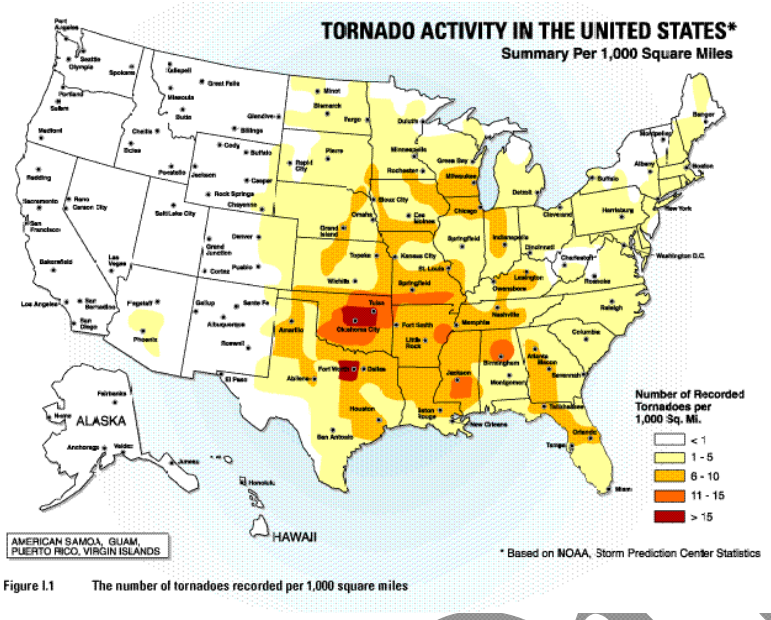


Figure I.1 The number of tornadoes recorded per 1,000 square miles

3.2.2.3 The severity of tornados is measured on the Fujita Tornado Scale (see below). Almost 70% of all tornadoes are measured F0 and F1 on the Fujita Tornado Scale, causing light to moderate damage, with wind speeds between 40 and 112 miles per hour. F4 and F5 tornadoes are considerably less frequent, but are the big killers. 67 percent of all tornado deaths were caused by F4 and F5 storms, which represent only 1% of all tornadoes. From 1950 through 2010, Creek County experienced four tornados with a Fujita Scale magnitude greater than F3.

Table 3-3
Fujita Tornado Scale

Category	Wind Speed (mph)	Damage
F0	Gale tornado (40-72)	**Light:** Damage to chimneys, tree branches, shallow-root trees, sign boards
F1	Moderate tornado (73-112)	**Moderate:** Lower limit is beginning of hurricane wind speed—surfaces peeled off roofs, mobile homes pushed off foundations or overturned, cars pushed off roads
F2	Significant tornado (113-157)	**Considerable:** Roofs torn off frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted, light-object missiles generated
F3	Severe tornado (158-206)	**Severe:** Roofs and some walls torn off well-constructed houses, trains overturned, most trees in forest uprooted, cars lifted off the ground and thrown
F4	Devastating tornado (207-260)	**Devastating:** Well-constructed houses leveled, structures with weak foundations blown off some distance, cars thrown and large missiles generated
F5	Incredible tornado (261-318)	**Incredible:** Strong frame houses lifted off foundations and carried considerable distance to disintegrate, automobile-sized missiles fly through the air in excess of 100 yards, trees debarked

On February 1, 2007, the Fujita scale was decommissioned in favor of the more accurate Enhanced Fujita Scale, which replaces it. None of the tornadoes recorded on or before January 31, 2007 will be re-categorized. Therefore maintaining the Fujita scale will be necessary when referring to previous events.

Table 3-4: Enhanced Fujita Tornado Scale

Enhanced Fujita (EF) Scale		
Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	**Light damage:** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage:** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage:** Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	**Severe damage:** Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage:** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage:** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); high-rise buildings have significant structural deformation; incredible phenomena will occur.
source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale		

A typical tornado hazard would be an EF0 event, as defined in Table 3-3 above, the Enhanced Fujita Tornado Scale. The worst case tornado hazard would be an EF5 event, as defined in Table 3-3 above. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.2.4 Map Number 6 in Appendix 1 shows past tornado events in Creek County. According to the National Climatic Data Center, from 1950 through 2010, Creek County has experienced 61 tornados, causing an estimated $51.9 million in property damage. The City of Drumright was hit by an F-4 tornado in 1974, causing 13 deaths, 135 injuries, with $2.5 million in damages. This tornado had such an impact on the community, Drumright Schools' nickname is the "Tornados", and a caricature of tornado is painted on the water tower.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.2.5 Meteorological conditions have not changed, so future tornado events should occur at the same probability as previous events. No area of the County is any more or less at risk from the tornado hazard. According to the likelihood rating from Appendix 6, the likelihood of a tornado hazard in the County is "highly likely".

3.2.2.6 Creek County is located in what is considered an active part of tornado alley. Every structure in the County is vulnerable to tornadoes. Structures, automobiles, persons, agriculture, and utilities can sustain damage from tornados. Utility service outages can affect large segments of the population for long periods of time. Economic losses from homeowners and businesses alike can be devastating. Food spoilage with lack of refrigeration, gas pumps not

operating, and daily life activities can all come to a halt. People displaced from homes that are damaged and destroyed also create a new set of challenges with the basics of food, shelter and clothing.

On the lower end, damage from an F0 tornado with winds from 40-72 mph can result in destruction of road signs, tall structures, trees, and possible damage to shingled roofs. Mid –range F2 and F3 tornadoes with winds from 113-206 mph will result in considerable damage. Roofs will be torn off structures, mobile homes completely demolished, most trees and plant life destroyed, objects as big as cars thrown small distances (as well as other light missiles being generated), and trains being blown over can result from these storms. The worst case is the F5 tornado with winds from 261-318 mph. Total destruction will occur in the path of the tornadoes, which have been up to ½ mile wide in the past. Homes, automobiles, appliances, outbuildings, and anything outdoors can be picked up and thrown long distances as large missiles. Most plant life including lawns, shrubs and trees are completely destroyed.

Utility infrastructure such as power lines, substations, water towers, and water wells, are vulnerable and can be severely damage or destroyed from a tornado. Emergency vehicles responding to the devastated areas can have trouble responding due to down power lines and debris in roadways. Livestock is vulnerable during tornado events and are often killed since there is little protection for the animals on the open range. People caught in the path of a tornado who don't take shelter have the potential of being injured or killed. Residents most vulnerable to tornadoes are those living in mobile homes.

Historically the tornado will move in a southwest to northeast direction, but can move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since the tornadoes form at different strengths, in random locations, and create narrow paths of destruction.

Advances in meteorology and the use of Doppler radar allow efficient prediction of tornado formation before they occur. A network of storm watchers attempt to identify funnel clouds and report to various networks to alert the population. Even though these advances have significantly improved the available response time, tornadoes can still occur unexpectedly and without warning.

Utilizing storm spotters and early warning systems, county residents can take appropriate precautions during these events. As a result, casualty rates are low. The popularity of mobile/manufactured housing has increased susceptibility of existing structures to tornadoes. The use of better building techniques, tie-down systems and the availability of storm shelters all help mitigate losses in the county.

3.2.3 High Wind Hazard

3.2.3.1 Wind is defined as the motion of air relative to the earth's surface. Extreme windstorm events are associated with cyclones, severe thunderstorms, and accompanying phenomena such as tornadoes and downbursts. Winds vary from zero at ground level to 200 mph in the upper atmospheric jet steam at 6 to 8 miles above the earth's surface. The mean annual wind speed in the mainland United States is reported by FEMA to be 8 to 12 mph, with frequent speeds of 50 mph and occasional wind speeds of greater than 70 mph. Oklahoma wind speeds average 10 miles per hour.

3.2.3.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from a high wind hazard than another.

3.2.3.3 The magnitude of the high wind hazard is categorized on various wind scales, such as the Beaufort, Saffir-Simpson, and the Fujita measurement scales. The tables below containing the Beaufort and Saffir-Simpson scales show that there is little consensus of opinion as to what wind speeds produce various damages. (The Fujita Scale is shown in the section 3.2.2, "Tornado Hazard"). The National Weather Service (NWS) issues Severe Thunderstorm Warnings whenever a thunderstorm is forecast to produce wind gusts to 58 miles per hour (50 knots) or greater and/or hail one inch in diameter or larger. Hail size increased from ¾ inch to one inch on January 5, 2010, for warning issues. The hail hazard will be addressed in Section 3.2.5.

Table 3-5
Beaufort Scale

Force	Wind Speed (mph)	Damages
9	47-54	**Strong gale:** Chimneys blown down, slate and tiles torn from roofs
10	55-63	**Whole gale:** Trees broken or uprooted
11	64-75	**Storm:** Trees Uprooted, cars overturned
12	75+	**Severe Storm:** Devastation is widespread, Buildings destroyed

Table 3-6
Saffir-Simpson Scale

Category	Wind Speed (mph)	Storm Surge (feet)	Damages
1	74-95	4- 5	**Minimal:** Trees, shrubbery, unanchored mobile homes, and some signs damaged, no real damage to structures
2	96-110	6-8	**Moderate:** Some trees toppled, some roof coverings damaged, major damage to mobile homes
3	111-130	9-12	**Extensive:** Large trees are toppled, some structural damage to roofs, mobile homes destroyed, structural damage to small homes and utility buildings
4	131-155	13-18	**Extreme:** Extensive damage to roofs, windows, and doors, roof systems on small buildings completely fail, some curtain walls fall
5	155+	18+	**Catastrophic:** Roof damage is considerable and widespread, window and door damage is severe, extensive glass failure, entire buildings could fall

A typical high wind hazard would be a Saffir-Simpson Scale category 1 event, as defined in Table 3.3 above, the Saffir-Simpson Scale. The worst case high wind hazard would be a Saffir-Simpson Scale category 5 event, as defined in Table 3.3 above. A proposed action plan will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.3.4 According to the National Climatic Data Center, there have been 287 recorded high winds events during the period of 1950 through 2010, causing an estimated $1,916,000 in property damage.

Appendix 6 summarizes previous occurrences of this hazard.

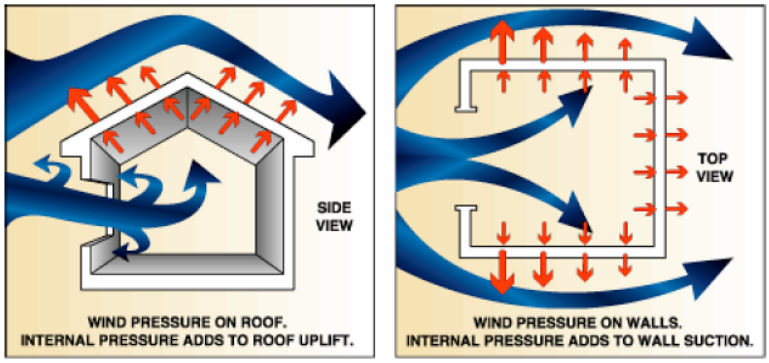
3.2.3.5 The majority of the United States is at some risk of high wind hazards, including Creek County. Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a high wind hazard in the County is "highly likely".

3.2.3.6 Property damage and loss of life from windstorms are increasing due to a variety of factors. Use of manufacturing housing and mobile homes is on an upward trend, and this type of structure provides less resistance to wind than conventional construction. With the deteriorating condition of older homes, and the increased use of aluminum-clad mobile homes, and poorly designed homes, the impacts of wind hazards will likely continue to increase.

Winds are always part of severe storms such as tornadoes and blizzards, but do not have to accompany a storm to be dangerous. Down-slope windstorms, straight-line winds, and microbursts can all cause death, injury, and property damage. Very little available data exists separate from thunderstorms or tornado data. Any efforts made to mitigate for tornadoes or thunderstorm winds should address the hazard of high winds.

Extreme winds can cause several kinds of damage to a building. The diagram below shows how extreme winds affect a building and helps explain why these winds cause buildings to fail. Wind speeds, even in these extreme wind events, rapidly increase and decrease. An obstruction, such as a house, in the path of the wind causes the wind to change direction. This change in wind direction increases pressure on parts of the house. The combination of increased pressures and fluctuating wind speeds creates stress on the house that frequently causes connections between building components to fail. For example, the roof or siding can be pulled off or the windows can be pushed in.

Diagram of Windstorm Effects



Buildings that fail under the effects of extreme winds often appear to have exploded, giving rise to the misconception that the damage is caused by unequal wind pressures inside and outside the building. This misconception has led to the myth that during an extreme wind event, the windows and doors in a building should be opened to equalize the pressure. In fact, opening a window or door allows wind to enter a building and increases the risk of building failure.

Damage can also be caused by flying debris (referred to as windborne missiles). If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, walls, or the roof. For example, an object such as a 2" x 4" wood stud weighing 15 pounds, when carried by a 250-mph wind, can have a horizontal speed of 100 mph and enough force to penetrate most common building materials used in houses today. Even a reinforced masonry wall will be penetrated unless it has been designed and constructed to resist debris impact during

extreme winds. Because missiles can severely damage and even penetrate walls and roofs, they threaten not only buildings but the occupants as well.

In addition to structural issues, high winds can affect electrical and other utilities with service outages. Power lines can ground out or knocked down causing loss of electrical service. Travel can be disrupted with the loss of stop lights, street lights and dangerous cross winds making travel difficult. There could also be loss of water, sewer, and communications abilities.

3.2.4 Lightning Hazard

3.2.4.1 Lightning is a discharge of atmospheric electricity, accompanied by a vivid flash of light, from a thunderstorm, frequently from one cloud to another, sometimes from a cloud to the earth. The sound produced by the electricity passing rapidly through the atmosphere causes thunder.

Within the thunderstorm clouds, rising and falling air causes turbulence which results in a build up of a static charge. The negative charges concentrate in the base of the cloud. Since like charges repel, some of the negative charges on the ground are pushed down away from the surface, leaving a net positive charge on the surface. Opposite charges attract, so the positive and negative charges are pulled toward each other. This first, invisible stroke is called a stepped leader. As soon as the negative and positive parts of the stepped leader connect there is a conductive path from the cloud to the ground and the negative charges rush down it causing the visible stroke. Thunder is caused by extreme heat associated with the lightning flash. In less than a second, the air is heated from 15,000 to 60,000 degrees. When the air is heated to this temperature, it rapidly expands. When lightning strikes very close by, the sound will be a loud bang, crack or snap. Thunder can typically be heard up to 10 miles away. During heavy rain and wind this distance will be less, but on quiet nights, when the storm is many miles away, thunder can be heard at longer distances.

3.2.4.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from a lightning hazard than another.

3.2.4.3 The type of lightning is a measure of the severity of the lightning hazard. Cloud-to-ground is the more severe type is terms of potential cause of damage. The table below from the National Climatic Data Center shows the types and frequency categories of lightning. The more severe type of lightning; coupled with an increased frequency, pose a greater lightning hazard. Although lighting is an identified hazard in the County, the effects have been minimal and the consensus of the CCEMAC that lightning events is just under-reported.

Lightning strikes can also cause high-voltage power surges that have the ability to seriously damage equipment and valuable data if surge protection devices are not installed properly. Property damage from power surges and resulting fires can destroy not only the electronics in private homes, but also unprotected PBXs, telecommunications equipment, wireless systems, and radio base stations.

A typical lightning hazard would be lightning that stays in the air, not touching the ground. The worst case lightning event would be a cloud to ground lightning type where the lightning strikes a large public gathering location, which could result in mass causalities. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

Table 3-7: Type of Lightning

Type	Contraction	Definition
Cloud to Ground	CG	Lightning occurring between cloud and ground.
In Cloud	IC	Lightning occurring within the cloud.
Cloud to Cloud	CC	Streaks of lightning reaching from one cloud to another.
Cloud to Air	CA	Streaks of lightning which pass from a cloud to the air, but do not strike the ground.

Table 3-8: Frequency of Lightning

Frequency	Contraction	Definition
Occasional	OCNL	Less than 1 flash per minute.
Frequent	FRQ	About 1 to 6 flashes per minute
Continuous	CONS	More than 6 flashes per minute.

3.2.4.4 For Creek County, the National Climatic Data Center (NCDC) reports five lightning events during the 61 year period from 1950 through 2010, causing $268,000 in property damage. With the frequent wind and thunderstorm activity the county experiences, it is certain that lightning strikes occurred more often, but were just not all reported.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.4.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a lightning hazard in Creek County is "unlikely".

3.2.4.6 The largest vulnerability to lightning is the potential loss of human life. Property damage can also occur to structures, electrical equipment, water wells, etc. Anyone outdoors during a thunderstorm is exposed and at risk of injury from lightning. Most people are injured or killed by lightning will participating in some form of recreation. Some of the area swimming pools and water parks are installing early warning devices for the danger of lightning strikes. Damage to trees and homes would generally be under $1,000 if a strike did occur.

3.2.5 Hail Storm Hazard

3.2.5.1 Hail is frozen water droplets formed inside a thunderstorm cloud. They are formed during the strong updrafts of warm air and downdrafts of cold air, when the water droplets are carried well above the freezing level to temperatures below 32 deg F, and then the frozen droplet begins to fall, carried by cold downdrafts, and may begin to thaw as it moves into warmer air toward the bottom of the thunderstorm. This movement up and down inside the cloud, through cold then warmer temperatures, causes the droplet to add layers of ice and can become quite large, sometimes round or oval shaped and sometimes irregularly shaped, before it finally falls to the ground as hail.

3.2.5.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from the hail storm hazard than another.

3.2.5.3 The severity of damage caused by hail storms depends on the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds. The magnitude of a hail storm is as follows;

Table 3-9
HAILSTONE SIZES

Diameter	Example	Diameter	Example
1/4 inch	Pea	1 ¾ inches	Golf Ball
1/2 inch	Marble	2 ½ inches	Tennis Ball
3/4 inch	Penny	2 ¾ inches	Baseball
7/8 inch	Nickel	3 inches	Tea Cup
1 inch	Quarter	4 inches	Grapefruit
1 ½ inches	Ping Pong Ball	4 ½ inches	Softball

The extent of the hazard can range from damage through destruction of structures and personal property to bodily injury, depending on the diameter. The National Climatic Data Center has reported hail in the County up to 2 ¾ -inches in diameter.

The National Weather Service (NWS) issues Severe Thunderstorm Warnings whenever a thunderstorm is forecast to produce wind gusts of 58 miles per hour (50 knots) or greater and/or hail size one inch in diameter or larger. Prior to January 5, 2010 the criteria for hail was ¾ inch or larger.

A typical hail storm hazard would be hailstones that are noticeable but cause no damage. The worst case hail storm event would be a hail storm event where the hailstones exceed the maximum diameter reported by a recording agency such as the National Climatic Data Center, causing wide-spread structure damage and at a time of a large public outdoor gathering causing injuries to persons not under cover of a substantial structure. A proposed action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.5.4 According to the National Climatic Data Center, Creek County experienced 207 hail hazard events of hail diameter 1-inch and greater during the period from 1950 through 2010, causing an estimated $365,000 in property damage.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.5.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a future hail hazard in Creek County is “highly likely”.

3.2.5.6 Vulnerability is difficult to evaluate since hail occurs in random locations and creates relatively narrow paths of destruction. Hail is capable of causing considerable damage to crops, buildings, and vehicles, and occasionally death to farm animals. Hail can also strip leaves and small limbs from non-evergreen trees. While large hail poses a threat to people caught outside in a storm, it seldom causes loss of human life.

- Costs and losses to agricultural and livestock producers
- Reduced yields and crop loss
- Injuries or loss of livestock
- Damage to barns and other farm buildings
- Damage to trees resulting in increased susceptibility to disease
- Urban, residential, and commercial
- Damage to buildings
- Roofs

- Windows
- Damage to automobiles, trucks, trains, airplanes, etc.
- Disruptions to local utilities and services
- Power
- Communications
- Transportation

Past storms in the Creek County have showed crops losses from slight damage of less than 10% production loss to total devastation of the crop with 100% loss. Damage to vehicles can range from several hundred dollars to total loss of the vehicle. At times when large parking lots or dealerships get hit, losses can be in the millions of dollars. Loss from a major hailstorm damaging automobiles and structures in a larger city could total in the tens of millions of dollars.

3.2.6 Winter Storm Hazard

3.2.6.1 All winter storms are accompanied by cold temperatures and blowing snow, which can severely reduce visibility. A severe winter storm is one that drops 4 or more inches of snow during a 12 –hour period, or 6 or more inches during a 24- hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately on impact. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can impact a community or region for days, weeks, and even months. Storm effects such as extreme cold, flooding, and snow accumulation can cause hazardous conditions and hidden problems for people in the affected area. People can become stranded on the road or trapped at home, without utilities or other services. Residents, travelers and livestock may become isolated or stranded without adequate food, water and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation; house fires occur more frequently in the winter due to the lack of proper safety precautions while using home heating equipment.

3.2.6.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from the winter storm hazard than another.

3.2.6.3 A winter storm can range from moderate snow (2 to 4 inches over 12 to 24 hours) to blizzard conditions (4 to 6 inches over 12 to 24 hours) with high winds, freezing rain or sleet, heavy snowfall with blinding wind-driven snow and extremely cold temperatures that lasts several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by cold temperatures and blowing snow, which increases the severity of the winter storm.

The Balthrop Ice Scale attempts to quantify the severity of the winter storm hazard. The scale is shown in Table 3-12.

Table 3-10: The Balthrop Ice Scale

Level	Cause	Effect
Level 1; Nuisance Event, No Major Impact	Freezing rain and sleet, but little ice accumulation. Roads not hazardous. Ice forming on grass.	Little to no effect on the State of Oklahoma.
Level 2; Minor Event, Caution Advised	No measurable ice. Black ice on roads and bridges. Winter Weather Advisory.	Untreated roadways and bridges may become hazardous and slick. Livestock may need additional supplemental feed.
Level 3; Major Event, Isolated Emergency Conditions in the State of Oklahoma	Ice accumulations of ¼ to ½ inches. Reduced visibility. Winter Storm Warning.	Widespread hazardous road conditions. Travel discouraged. Isolated power outages because of down power lines from ice accumulations. Tree damage. Livestock loss potential increases. Supplemental feed necessary.
Level 4; Extreme Event, The State of Oklahoma Under Full State of Emergency	Crippling event. Winds over 35 mph. Little to no visibility. Ice accumulations of more than ½ inch. Blizzard Warning.	Road conditions hazardous to impassable. People and livestock isolated. Widespread power and utility outages. Infrastructure damage. High potential for loss of livestock. Structures threatened from accumulating ice. Communications infrastructure lost from ice accumulation. May be a long lasting event.

A typical winter storm hazard would be a Level 1 event, as defined by the Balthrop Ice Scale, a nuisance event. The worst case winter storm hazard would be a Level 4 event, where transportation is stopped, widespread power outages, livestock loss is likely, and the duration may be long. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.6.4 According to the National Climatic Data Center, 30 snow and ice events were reported in Creek County from 1950 through 2010, causing an estimated $50,155,000 of property damage. The total areas affected within the county were not reported, but estimated to have affected large areas of the County.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.6.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a winter storm hazard in Creek County is “highly likely”.

3.2.6.6 Creek County is affected periodically by heavy snow and ice that cause damage. Trees and power lines fall due to the weight of ice and snow causing damage to their surroundings as well as blocking streets and roads. Icy roads cause accident rates to increase and impair the ability for emergency vehicles to respond which can result in more injuries and a higher loss of life.

Winter storms can range from accumulating snow and/or ice over just a few hours to blizzard conditions with blinding wind-driven snow that can last several days. The aftermath from a damaging winter storm can continue to impact a region for weeks and even months. Economic losses can occur to livestock producers and any business in the affected areas. Water systems

being shut down or frozen can disrupt social services, schools, homes, and businesses. Carbon monoxide poisoning is always a possibility as homeowners and businesses use alternative heat sources to keep warm. Personal health can be affected in a variety of ways including mental and physical stress, frostbite or related injuries and inability to travel for care.

Cold waves pose a variety of threats to individuals and communities. The list below summarizes some of the most common impacts of cold waves.

- Costs and losses to livestock producers
  - Loss of livestock due to exposure
  - Greater mortality due to Increased vulnerability to disease
  - Increased feed costs
  - Reduced milk production
  - Cost of supplemental water for livestock if onsite ponds and streams are frozen
  - Machinery and farm vehicles that will not operate in cold weather
- Urban, residential, and commercial impacts
  - Availability of water for municipal use due to frozen and burst water lines
  - Homes with alternative energy sources
  - House fires from overburdened chimneys
  - Carbon monoxide poisoning from exhaust produced by heaters and generators
  - Vehicles that will not operate in cold weather
  - Cost of keeping transportation lines clear of ice and snow
- Health
  - Mental and physical stress in the form of "cabin fever"
  - Frostbite and hypothermia
  - Disruption of services
  - Government offices and schools closed
  - Garbage collection halted
- General economic effects
  - Revenue loss from lost production in business and industry
  - Negative impact of economic multipliers
  - Higher energy costs
  - Damage to animal species
  - Loss of wildlife, particularly if cold wave is coupled with prolonged snow cover that makes sources of food unavailable
  - Greater mortality due to Increased vulnerability to disease
  - Loss of trees and woody shrubs that are not hardy enough to survive prolonged exposure to cold temperatures, especially when soil moisture is low
  - Pollution from increased energy production

A major winter storm can be lethal. Preparing for cold weather conditions and responding to them effectively can reduce the dangers caused by winter storms.

Mitigating ice storm damage must be a joint effort by Local Community and County workers, private land owners, and corporate entities. County workers simply do not have the available resources to maintain all the wire systems in the County. Ordinances that require the maintenance of trees and shrubs surrounding the area of electric and telephone wires are a first step toward mitigating ice storm damage. Aggressive public education programs must be in place to alert people to the possible damages to their and other's property. Large corporations such as Oklahoma Gas and Electric do not have the man-power or financial resources to maintain all their lines. Regular trimming by all levels of participants can substantially reduce the damage caused by future episodes.

3.2.7 Heat Hazard

3.2.7.1 Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility. Drought occurs when a long period passes without substantial rainfall. A heat wave combined with a drought is a very dangerous situation.

3.2.7.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from the heat hazard than another.

3.2.7.3 The severity of the extreme heat is dependent on a combination of temperature and humidity. High temperatures, when combined with high humidity can put an area in the "Extreme Danger" category on the National Weather Service Heat Index scale. When extreme heat is combined with drought, excessively dry hot conditions that contribute to a high risk of life-threatening heat-related illnesses may result. The heat index is a measure of the severity of a heat hazard. The heat index can be related to a range of specific heat disorders. Creek County can experience heat index reading into the heat stroke range.

Table 3-11
Heat Index

Temperature (F) versus Relative Humidity (%)						
°F	90%	80%	70%	60%	50%	40%
80	85	84	82	81	80	79
85	101	96	92	90	86	84
90	121	113	105	99	94	90
95		133	122	113	105	98
100			142	129	118	109
105				148	133	121
110						135

HI	Possible Heat Disorder:
80°F - 90°F	Fatigue possible with prolonged exposure and physical activity.
90°F - 105°F	Sunstroke, heat cramps and heat exhaustion possible.
105°F - 130°F	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
130°F or greater	**Heat stroke highly likely with continued exposure.**

A typical heat hazard would be to persons experiencing temperatures reaching 90 degrees, as described in Table 3-14 above. The elderly population is most at risk from this high heat hazard. The worst case heat hazard event would be to persons exposed to temperatures exceeding 130 degrees where heat stroke is likely. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.7.4 According to the National Climatic Data Center, from 1950 through 2010, Creek County experienced ten extreme heat events. No structural damage was recorded for the heat hazard for the county.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.7.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a heat hazard in Creek County is "occasional".

3.2.7.6 In a normal year, approximately 175 Americans die from extreme heat. Between 1936 and 1975, nearly 20,000 people succumbed to the effects of heat and solar radiation. From 1979-1999, excessive heat exposure caused 8,015 deaths in the United States. On average approximately 400 people die each year from exposure to heat. In Oklahoma, July is generally the hottest month of the year, followed by August.

Heat kills by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature.

Most heat disorders occur because the victim has been overexposed to heat or has over exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality.

Extreme heat can have a serious economic impact on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, damage to food supplies may occur as the heat damages agricultural crops and livestock are susceptible to heat related injuries or death.

Young children, elderly people, and those who are sick or overweight are more likely to become victims to extreme heat. Other conditions that can limit the ability to regulate temperature include fever, dehydration, heart disease, mental illness, poor circulation, sunburn, prescription drug use, and alcohol use. Another segment of the population at risk is those whose jobs consist of strenuous labor outside. When temperatures reach 90 degrees and above, people and animals are more likely to suffer sunstroke, heat cramps, and heat exhaustion.

Another extreme heat hazard is air pollution. During summer months, consistent high temperatures and stagnant airflow patterns cause a build-up of hydrocarbons to form a dome-like ceiling over large cities. The abundance of factories, automobiles, lawn equipment, and other internal combustion machines emit high particulate matter that builds and worsens with the increase in temperature. The resulting stagnant, dirty, and toxic air does not move away until a weather front arrives to disperse it. When the particulate matter reaches a pre-determined level, an ozone alert is issued for the Tulsa area and implementation measures are undertaken to reduce the use of cars and the output of the offending chemicals. Ozone alerts usually include advisories for the elderly and those with breathing difficulties to stay indoors in air-conditioned environments.

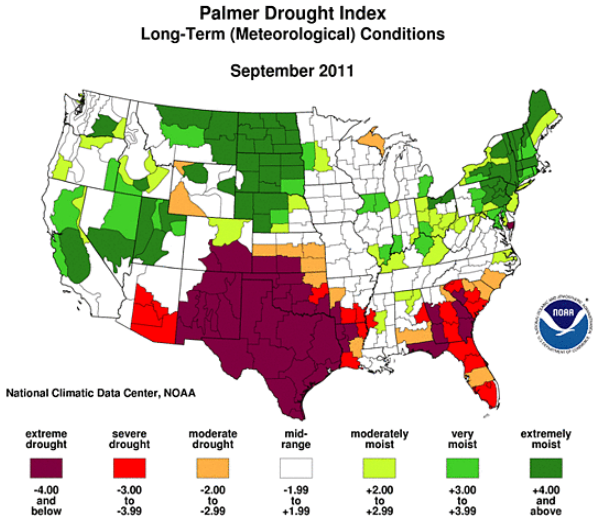
3.2.8 Drought Hazard

3.2.8.1 A drought is a period of drier-than-normal conditions that results in water-related problems. Precipitation (rain or snow) falls in uneven patterns across the country. When no rain or only a small amount of rain falls, soils can dry out and plants can die. When rainfall is less than normal for several weeks, months, or years, the flow of streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells decreases. If dry weather persists and water supply problems develop, the dry period can become a drought. The first evidence of drought usually is seen in records of decreased rainfall. Within a short period of time,

the amount of moisture in soils can begin to decrease. The effects of a drought on flow in streams and rivers or on water levels in lakes and reservoirs may not be noticed for several weeks or months. Water levels in wells may not reflect a shortage of rainfall for a year or more after the drought begins. A period of below-normal rainfall does not necessarily result in drought conditions. Some areas of the United States are more likely to have droughts than other areas. In humid, or wet, regions, a drought of a few weeks is quickly reflected in a decrease in soil moisture and in declining flow in streams. In arid, or dry, regions, such as Oklahoma, people rely on ground water and water in reservoirs to supply their needs. They are protected from short-term droughts, but may have severe problems during long dry periods because they may have no other water source if wells or reservoirs go dry.

3.2.8.2 The location of this hazard is uniform over the entire County area. No area of the County is more of less at risk from the drought hazard than another.

3.2.8.3 The Palmer Drought Index was developed in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought severity index. The Palmer Index is most effective in determining long term drought; a matter of several months. It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. NOAA has used this index to classify the drought hazard through the continental United States. As of September, 2011, Creek County was in the severe to extreme severity range of the Palmer Drought Index. The national map showing the September 2011 Palmer Drought Index is shown below.



A typical drought hazard would be a mid-range to moderate Palmer Drought Index, where some form of voluntary water rationing would be encouraged but not required, and the only damage would be to under watered lawns. The worst case drought hazard event would be a Palmer Drought index of negative 4.00 and below, an extreme drought, where it lasts for months to years. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.8.4 One of the greatest natural disasters in U.S. history and the most severe and devastating to Oklahoma was the decade-long drought in the 1930s that has become known as the Dust Bowl. Reaching its peak from 1935 through 1938, high temperatures and low rainfall combined to destroy crops and livestock. High winds literally blew the land away, causing

massive soil erosion. Hundreds of small rural communities were ruined and about 800,000 people were displaced. The total expenditure by the American Red Cross for drought relief in Oklahoma in 1930-1931 was the third largest ever in the nation.

According to the National Climatic Data Center, there have been 11 drought events in Creek County from 1950 through 2010.

Appendix 6 summarizes previous occurrences of this hazard.

3.2.8.5 Meteorological conditions have not changed so future events should occur at the same probability as the previous events. According to the likelihood rating from Appendix 6, the likelihood of a heat hazard in Creek County is "occasional".

3.2.8.6 Lack of fresh water is damaging to livestock and crops. During the summer months, temperatures in the Creek County area can easily reach over 100 degrees Fahrenheit. Often these high temperatures will persist for many days and possibly for weeks. When these high temperatures coincide with times of no rain, drought has been reported for areas of Creek County. Drought conditions increase fire hazards and reduces water supply. Heat and drought also effect local workforce capabilities. Workers exposed to these elements must be monitored for heat exhaustion and heat stroke. Another problem associated with drought is stale water. Areas of stale water are known to produce deadly bacteria.

Drought impacts in a number of ways, spanning all regions, and is capable of affecting the economy as well as the environment. Specific impacts can include

- reduced crop, rangeland;
- increased livestock and wildlife mortality rates;
- reduced income for farmers and agribusiness;
- increased fire hazard;
- reduced water supplies for municipal/industrial, agricultural and power uses;
- damage to fish and wildlife habitat;
- increased consumer prices for food;
- reduced tourism and recreational activities;
- unemployment;
- reduced tax revenues because of reduced expenditures; and
- foreclosures on bank loans to farmers and businesses.

The most direct impact of drought is economic rather than loss of life or immediate destruction of property. While drought impacts in Oklahoma are numerous and often dependent upon the timing and length of individual drought episodes, the greatest impacts of drought are usually experienced in the agricultural community. In addition to the obvious direct losses of both crop and livestock production due to a lack of surface and subsurface water, drought is frequently associated with increases in insect infestations, plant disease, and wind erosion.

Of course, one of the most significant potential impacts of drought relates to public water supply. In metropolitan areas, including Creek County, there may be a need to stop washing cars, cease watering the grass and take other water conservation steps. In smaller communities, reduced flow in rivers and streams can have a significant affect on the water amount allowed for municipal use. Hot weather during the summer increases demand and subsequent use of supplies, as well as evaporation. In turn, increased water demand can stress many smaller and/or antiquated delivery and treatment facilities to the point of collapse. Prolonged drought has a much greater impact on

rural communities, which usually rely on relatively small watersheds and are especially vulnerable during such periods.

Water shortages can also affect fire fighting capabilities in both urban and rural settings through reduced water flows and pressures. Most droughts dramatically increase the danger of fires on wild land. Although drought can have serious impact during winter months, it is most often associated with extreme heat. Wildlife, pets, livestock, crops, and humans are vulnerable to the high heat that can accompany drought.

3.2.9 Expansive Soils Hazard

3.2.9.1 Soils and soft rock that tend to swell or shrink due to changes in moisture content are commonly known as expansive soils. Changes in soil volume present a hazard primarily to structures built on top of expansive soils. The most extensive damage occurs to highways and streets. The effect of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. Expansive soils can be recognized either by visual inspection in the field or by conducting laboratory analysis. Shales, clay shales, and residual soils containing smectite often have a characteristic "popcorn" texture, especially in semiarid areas.

3.2.9.2 The Natural Resources Conservation Service (NRCS) has identified the soils in Creek County. The expansive tendency of a soil is a function of its shrink-swell potential. The locations of these types of soils are shown on Map Number 7 in Appendix 1.

The soil data for Creek County is from the State Soil Geographic (STATSGO) data base. The STATSGO data base is designed for multi-county resource planning, and is not detailed enough for interpretations at the county level. The soil maps for STATSGO are compiled by generalizing the more detailed SSURGO soil maps, Soil Survey Geographic (SSURGO) data base. The STATSGO data base is raster GIS data; each map unit is assigned an attribute value by sampling areas on more detailed maps and expanding the data statistically to characterize all map units. Raster type data cannot be used for spatial analysis; however, it is shown in Map Number 7 for a general location of expansive soils throughout the county.

3.2.9.3 The NRCS sorts this shrink-swell potential soil property in Creek County into five categories; very low, low, moderate, high, and very high. This is the range of magnitude of an expansive soils hazard. Shrink-swell potential categories are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The categories are very low, a change of less than 1%; low, 1 to 3%; moderate, 3 to 6%; high, 6 to 9%; and very high, greater than 9%. Map Number 8 in Appendix 1 illustrates the scattered areas within the County that have a high shrink-swell potential. Approximately 40% of the County falls into this category.

A typical expansive soils hazard would be to structures built in areas of high shrink-swell potential that were not built with any foundation displacement protection, such as post-tension reinforcing in foundations. The worst case expansive soils hazard event would be to structures as described above, but during extreme and extended drought conditions where the soils dry out to such a depth causing voids to occur which would increase the circumstances for foundations to deflect causing foundation and structure damage. An action plan item will be included to try to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.9.4 No information is available for the Creek County area on how expansive soils have damaged structures. This hazard develops gradually and thus not usually reported, largely because a catastrophic expansive soils hazard event has not occurred

3.2.9.5 The soils' properties have not changed so future occurrences of soils expansion and contraction will continue. An estimate of future occurrences is rated as "unlikely", shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6, because no data is reported for this hazard.

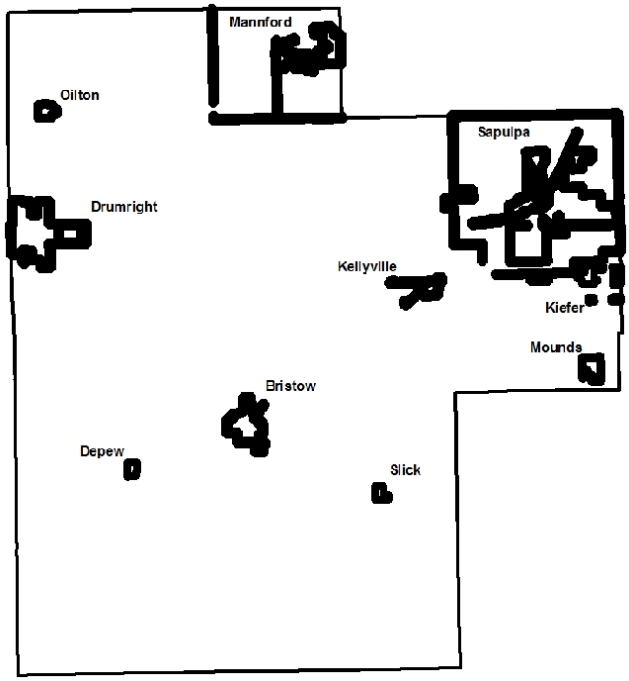
3.2.9.6 There is no need to address expansive soils in this plan due to the lack of data related to damage and there is no justification for mitigating vulnerabilities. Vulnerabilities include structures with foundations such as homes and businesses, concrete slabs in driveways and sidewalks, and parking lots. Asphalt surfaces such as highways and runways could be affected. These structures are affected because expansive soils cause uneven settlement of the soil under the structures' foundations. This causes cracking and damage to the foundation and structure above the foundation, such as a building's wall and a road's pavement.

3.2.10 Wildfire Hazard

3.2.10.1 Wildfires are defined as the uncontrolled burning of highly vegetated areas, usually in forests and wooded areas. Grass fires in Creek County pose a problem every year.

3.2.10.2 According to County Emergency Management, fire locations are more frequent around the more populated areas; however, all locations throughout the county are prone to grass fires. The locations of the fire departments in Creek County are shown on Map Number 8 in Appendix 1.

The urban interface is where the main risk and vulnerability is, and exits around the incorporated communities in Creek County. The following chart is a display of the urban interface location, in black, around the incorporated Creek County communities.



Urban Interface

3.2.10.3 The County's susceptibility to a wildfire is dependent upon seasonal environmental factors such as current and antecedent weather (including wind velocity and humidity), fuel types, moisture, temperature, and live and dead vegetation. Changes in these factors raise or lower the fire danger rating throughout the county. A typical wildfire hazard would be a grass fire, in which a Fire Department is dispatched to put out the fire before it causes any damage to crops, structures, or persons. The worst case wildfire scenario would be an event that could not be controlled before it overwhelms a community, causing damage to crops, structures, and persons. Although the number of incidences indicate that wildfires are likely to occur, most wildfires are small in size and contained by local resources. Therefore, the fire departments do not consider wildfires to be a major threat to the County overall. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.10.4 In Creek County, municipal and rural volunteer fire departments respond to numerous grass fires every year. The participating communities' fire departments do not have data to quantify this, but committee members report their municipal fire departments respond to many, more than one, grass fires every year.

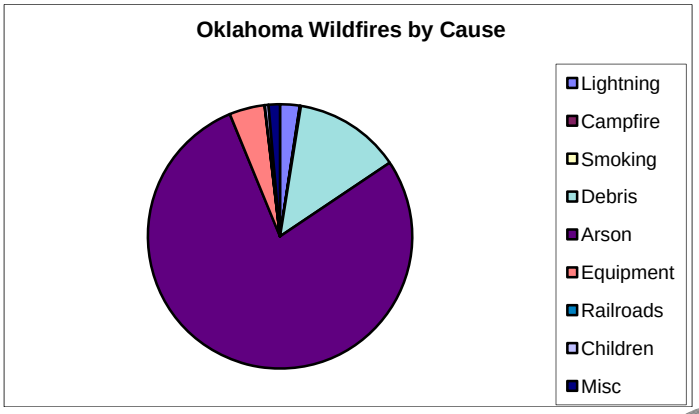
3.2.10.5 Creek County Fire Departments are continuing campaigns to educate the public on the causes and effects of fires. However, all fires cannot be prevented so this hazard will continue. The likelihood rating for wild fires in the County is "highly likely". This estimate of future occurrences is taken from the Likelihood Rating scale in the Hazard Summary Table in Appendix 6 because the committee members report numerous fire department runs per year responding to grass fires.

3.2.10.6 Periods of drought, dry conditions, high temperatures, and low humidity set the stage for wildfires. Areas along railroads and people whose homes are in woodland settings (especially cedar woodlands) in rural areas have an increased risk of wildfire. The sparsely populated tall grassed range lands, are capable of experiencing large sweeping fires. Ironically, fire suppression is capable of creating larger fire hazards, because live and dead vegetation is allowed to accumulate in areas where fire has been excluded. The especially large accumulations of deadfall throughout the county resulting from the severe ice storms of 2000 and 2007, is becoming a concern to firefighters.

People start more than four out of every five wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are another leading cause of wildfires. Other sources of ignition include railroads, catalytic converters on automobiles, and spontaneous ignition of hay bales. Wildfires that do not encounter a human population are difficult to calculate damages. Homes and businesses that are burned in naturally occurring fires are usually privately owned. When wild lands are destroyed by fire, the resulting erosion can cause heavy silting of streams, rivers, and reservoirs. Serious damage to aquatic life, irrigation, and power production then occurs.

This vulnerability to wildfire results in over 18,000 wildfires in the State each year. These fires burn about 300,000 acres. Over 97% of these wildfires are human caused. In fact, Oklahoma's fire risk is more closely associated with the presence of people than with fire danger or fuel types. Since human activity accounts for such a high percentage of the wildfires, there is limited opportunity for mitigation through public awareness and education.

An action plan item will be included to collect detailed data on this wildfire hazard within the County to better document the impact of wildfires on the County.



Arson is also a large proportion of the percentage of wildfires. Based on the above data, Oklahoma has a high probability of future hazard events. On average, fires kill nearly 5,500 Americans each year. Over 30,000 people are injured in fires annually. In the United States, someone dies in a fire every 40 minutes. Most often, victims are children or the elderly. Nearly 25 percent of the fires that kill young children are started by children playing with fire. Approximately 1,300 senior citizens die in fires annually. Approximately three-quarters of all fire fatalities occur in residential dwellings. Each year in the US, fire causes over $2 billion worth of damage to homes.

3.2.11 Earthquake Hazard

3.2.11.1 An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates. Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach $200 billion. There are 45 states and territories in the United States at moderate to very high risk from earthquakes, and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter scale. These earthquakes were felt over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

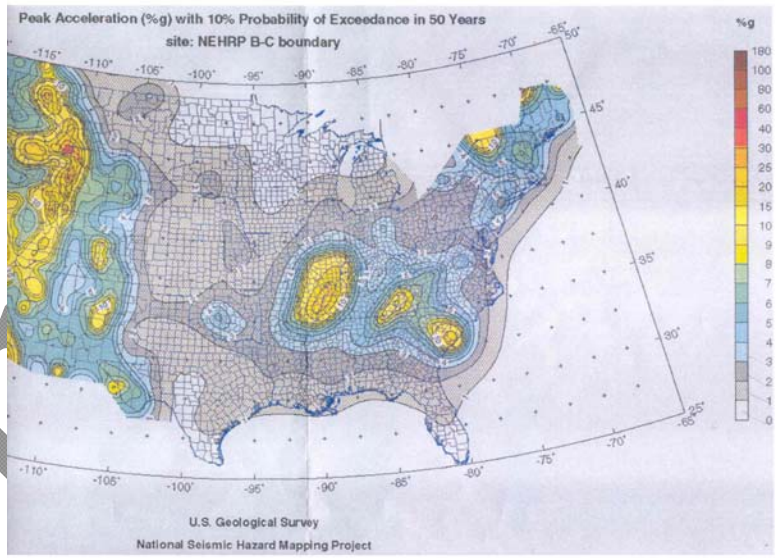
3.2.11.2 The faults most likely to affect Oklahoma are the New Madrid Fault, centered in the Missouri Bootheel region, and the Meers Fault, located in southwestern Oklahoma near Lawton. The distance from the Missouri Bootheel region to Pawhuska, OK, (in the center of Creek County) is approximately 370 miles, and the distance from the Meers fault region to Pawhuska is approximately 180 miles.

3.2.11.3 The severity of an earthquake can be expressed in several ways. The magnitude of an earthquake, usually expressed by the Richter Scale, is a measure of the amplitude of the seismic waves. The Richter Scale, named after Dr. Charles F. Richter of the California Institute of Technology, is the best known scale for measuring the magnitude of earthquakes. The scale is logarithmic. An earthquake of magnitude 2 is the smallest earthquake normally felt by people. Earthquakes with a Richter value of 6 or more are commonly considered major; great earthquakes have magnitude of 8 or more on the Richter scale.

Table 3-12
The Richter Scale

Magnitude	Description
1 to 3	Recorded on local seismographs, but generally not felt.
3 to 4	Often felt, with little to no damage reported.
5	Felt widely, slight damage near epicenter.
6	Damage to poorly constructed buildings and other structures within 10 kms.
7	"Major" earthquake. Causes serious damage up to 100 km (recent Taiwan, Turkey, Kobe, Japan, Iran and California earthquakes).
8	"Great" earthquake, great destruction, loss of life over several 100 km (1906 San Francisco, 1949 Queen Charlotte Islands).
9	Rare great earthquake, major damage over a large region over 1000 km (Chile 1960, Alaska 1964, and west coast of British Columbia, Washington, Oregon, 1700)

The USGS National Seismic Hazard Mapping, shown below, shows Creek County in the 2%g (peak acceleration), 10% probability of exceedance in 50 years area. According to the FEMA 386-2, "Understanding Your Risks", Step 1; areas with 2%g peak acceleration or less have a relatively low seismic risk, and an earthquake risk assessment is not warranted.



A typical earthquake event would be a magnitude 1 to 3 on the Richter Scale, which would be largely unfelt and no damage. The worst case earthquake hazard would be a magnitude 9 on the Richter Scale, causing a large amount of structure damage and personal injury over a large area. An action plan item will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.11.4 According to the National Climatic Data Center, there have been no earthquake events in Creek County from 1950 through 2010. On November 5, 2011, the state experienced its largest and third largest earthquakes in state history. A 4.8 magnitude earthquake occurred near

Prague at about 2:12 am, and then a 5.6 magnitude earthquake occurred near Sparks at about 10:53 pm. Both earthquakes were centered in Lincoln County, a county southwest of Creek County in central Oklahoma. The later earthquake surpassed the then largest earthquake in state history, a 5.5 magnitude earthquake near El Reno on April 9, 1952.

3.2.11.5 However, most earthquakes in the state are not felt. The most likely major earthquake event that could impact the area would probably originate in the New Madrid Fault Zone, which has been relatively quiet for 150 years. Seismologists estimate the probability of a 6 to 7 magnitude earthquake in the New Madrid area in the next 50 years to be higher than 90%.

According to the National Climatic Data Center, there have been no earthquake events in Creek County from 1950 through 2010; a likelihood rating of "unlikely". This estimate of future occurrences is shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6.

3.2.11.6 Because the extreme infrequency of major events in or near Creek County, the impact of the earthquake hazard does not justify mitigating vulnerabilities. Vulnerabilities would include all structures, homes, businesses and transportation infrastructure. Earthquake insurance is the only viable mitigation activity. Insurance would not lessen the event; just keep the hazard from becoming a financial disaster.

3.2.12 Hazardous Material Hazard

3.2.12.1 Hazardous materials are chemical substances that, if released or misused, can pose a threat to the environment or human health. These chemicals are used in industry, agriculture, medicine, research, and consumer goods. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or chemical accidents at plant sites. In the State of Oklahoma, communities are required to list facilities that either use or store Extremely Hazardous Substances (EHS) in their Emergency Operations Plans (EOP). EHS facilities are a subset of the Tier 2 facilities; and like the Tier 2 facilities, EHS facilities are reported annually to the Oklahoma Department of Environmental Quality by the users. The EHS facilities are incorporated into the Creek County plan update.

3.2.12.2 The locations of the Creek County EHS facilities are listed in the following table, and shown in Map Number 9 in Appendix 1.

Table 3-13
Creek County EHS Sites

Facility Name	Street Address	City
AT&T - BRISTOW CO - R64106	139 W 6TH AVE	Bristow
City of Bristow	38500 E0820 Rd.	Bristow
City of Bristow	302 Weatherwood Way	Bristow
City of Bristow	37620 West Highway 16	Bristow
City of Bristow	300 Weatherwood Way	Bristow
City of Bristow	304 weatherwood Way	Bristow
City of Bristow	24658 South Highway 48	Bristow
J-W Manufacturing Company	23630 S. 369th Ave.	Bristow
AT&T - OK3240	3.0 MI SOUTH OF DEPEW,OK	Depew
AT&T - DRUMRIGHT CO -	112 N. PENN	Drumright

R64118		
BAKER PETROLITE - Drumright,OK	NE Corner of Junction of Hwy 33, Hwy 16 and Hwy 99	Drumright
Drumright Wastewater Plant	1101 North Texas	Drumright
Drumright Water Plant	1606 West Broadway	Drumright
Level 3 Communications - Drumright - DRMROKAX	Rt 1 Box 124-5	Drumright
AT&T - OK2210	4MI W/O KLVL W/S 144	Kellyville
Oklahoma Communication System - Kellyville	102 S. Main	Kellyville
AT&T - KIEFER CO - R66127	634 E INDIANA AVE	Kiefer
AT&T - OK0230	KELLEYVILLE FT5S LIGHTGUIDE	Kellyville
CareFusion	400 East Foster Road	Mannford
Oklahoma Communications Systems - Mounds	15 E 13th Street	Mounds
AT&T - OK2260	Hwy 48, 8 Mi S Brisville	Newby
AT&T - OILTON CO - R64142	214 W. MAIN	Oilton
Don Denney--Peterson Lease, well #4, #18	SW 1/4, Sec 33, T19N, R7E	Oilton
AT&T - OK3230	61 MI WEST OF SAPULPA,OK	Sapulpa
AT&T - SAPULPA CO - R66150	302 S. MAIN	Sapulpa
FasCast Foundry	6107 West 71st Street	Tulsa
Nalco Plant 102	6717 S. 61 W. Ave	Tulsa
National Oilwell Varco Pump Plant	6750 South 57th West Avenue	Tulsa
Smithco Engineering, Inc.	6312 S. 39th Street	Tulsa
Thermal Specialties, Inc.	8181 South 88 West Ave.	Tulsa

3.2.12.3 The location and extent of the hazardous material hazard in Creek County are the EHS fixed location sites. The sites include buildings or property where EHS materials are manufactured or stored, and are regulated nationally under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) by the U.S. Environmental Protection Agency (EPA), and in Oklahoma by the Department of Environmental Quality.

A typical hazardous material hazard scenario would be an automobile accident where gasoline (which is not an EHS) is spilled and the local fire department responds. The worst case scenario would be responding to facility that contains a hazardous material that has not been properly documented so the responders may not be properly prepared for the hazardous material they would be encountering. A proposed action plan will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.12.4 For the evaluation of previous occurrences of hazardous material events, traffic accidents with gasoline spills were included in the number of hazardous material events experienced by the County, in addition to responding to incidents at EHS facilities. Throughout the County, municipal fire departments respond to more than one vehicle accidents with gasoline spills per year. The participating communities' fire departments do not have data to quantify this, but committee members report their community's fire department responds to numerous vehicle accidents with gasoline spills every year. Several Creek County Fire Departments have developed Hazardous Materials Standard Operating Guides. These guides provide Fire

Department personnel with guidance and assistance in determining incident levels for response to hazardous materials incidents.

3.2.12.5 Chemicals and hazardous materials are used throughout our society today, and will continue to be used in the future. And Creek County will continue to be exposed to this hazard. The likelihood rating for hazardous material events in the County is "highly likely". This estimate of future occurrences is taken from the Likelihood Rating scale in the Hazard Summary Table in Appendix 6 because the committee members report numerous vehicle accidents with gasoline spills every year.

3.2.12.6 Many parts of the County are susceptible to hazardous materials events due to the high number of highly traveled roads and highways. Potential impacts include disruptions in transportation if highways are shut-down. Local businesses and residences can be affected by the roads being closed. Soils and waterways could become contaminated by spills, but are generally contained and cleaned up by professional response teams.

3.2.13 Dam Break Hazard

3.2.13.1 A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings.

A dam failure is the collapse, breach, or other failure resulting in downstream flooding. Dam failures are primarily caused by hydrologic or structural deficiencies. A hydrologic deficiency is inadequate spillway capacity, caused by excessive runoff from a large amount of precipitation. Structural deficiencies include seepage, erosion, cracking, sliding, and overturning, mainly caused by the age of a dam and lack of maintenance.

The Oklahoma Water Resources Board coordinates the Oklahoma Dam Safety Program to ensure the safety of dams in the state. The program requires inspections every five years for low hazard structures and every three years for significant hazard structures. The program requires annual inspections for high hazard dams. Dams are designated as high hazard dams due to the presence of occupied dwellings immediately downstream. The following table lists the 13 Creek County dams in the program categorized as significant hazard or high hazard.

Table 3-14
Creek County Dams in the Oklahoma Dam Safety Program
(Source: OWRB – 2011)

NAME	CREEK	CITY	HAZARD CATEGORY
Parthenia Lake	**Anderson Creek**	**Tulsa**	**H**
Sapulpa Lake	**Euchee Creek**	**Sapulpa**	**H**
Sahoma Lake	**Rock Creek**	**Sapulpa**	**H**
SCS-Salt-Camp Creek Site-12	**Camp Creek**	**Creek County**	**H**
SCS-Little Deep Fork Site 33	**Sandy Creek Trib**	**Creek County**	**H**
SCS- Little Deep Fork Site 36	**Sandy Creek**	**Creek County**	**H**
Lake Massena	**Catfish Creek**	**Bristow**	**H**
Mannford Lake	**Little Salt Creek**	**Mannford**	**S**
Boren Dam	**Middle Duck Creek**	**Creek County**	**S**
SCS- Little Deep Fork Site 15	**East Spring Creek**	**Creek County**	**S**
SCS- Little Deep Fork Site 28	**Little Deep Fork**	**Creek County**	**S**
OK-No-Name 037071	**Childres Creek**	**Kiefer**	**H**
Heyburn Lake	**Polecat Creek**	**Sapulpa**	**H**

3.2.13.2 The dams listed in Table 3-10 above pose a high or significant risk, per the OWRB, to occupied dwelling in Creek County. Their locations are shown in Map Number 10 in Appendix 1. The location of the dam break hazard, the specific area of inundation from a failure of any of these dams is not available from the Corps of Engineers or the OWRB. The 500-year floodplain, downstream of the dam, was used to estimate the inundation area. The location of the dam break hazard is shown in Map Number 11 in Appendix 1. A mitigation action to create a dam inundation area map will be recommended.

3.2.13.3 For the extent of the dam break hazard, the specific area of inundation from a failure of any of these dams is not available. The 500-year floodplain, downstream of the dam, was used to estimate the inundation area. For the purposes of this hazard's risk assessment, the 500-year floodplain downstream of these lakes is the extent of this hazard. The worst case scenario of this hazard would be an unexpected failure of a high hazard dam, so the emergency personnel could not effectively notify people in the area of inundation of the impending event. A proposed action plan will be included to collect detailed data on this hazard, as well as all hazards, to better document typical and much worse events.

3.2.13.4 Creek County has never been flooded by a dam failure. Its impact on the County would be similar to the flood hazard. Nationally, the most famous dam break event occurred at Johnstown, PA. The South Fork Dam was built across Little Conemaugh River 14 miles upstream of Johnstown. In 1889, South Fork Dam failed, and the resulting flood on the Little Conemaugh River caused over 2200 fatalities.

According to the National Climatic Data Center, there have been no dam break events in Creek County from 1950 through 2010.

3.2.13.5 Never say never, but continued dam inspection and proper maintenance should continue to keep these dams from failing. Communities in Creek County contract with private engineering firms to annually inspect the dams as required and report to the Oklahoma Water Resources Board. Communities that use impoundments from dams for a water source in the County are responsible for any required maintenance. According to the County Emergency Management Department,, there have been no dam breaks in Creek County from 1950 through 2010; a likelihood rating of "unlikely". The likelihood of future hazard event occurrences are shown in the Likelihood Rating field in the Hazard Summary Table in Appendix 6.

3.2.13.6 As long as dams exist so does the chance for failure. The Oklahoma Water Resources Board (OWRB) coordinates the Oklahoma Dam Safety Program to ensure the safety of more than 4,500 dams in the state that falls within its jurisdiction. Dams falling within the OWRB's jurisdiction are non-Federally constructed and maintained dams which are: 1) greater than 6 feet in height with storage capacities of 50 acre-feet or more; and/or 25 feet or greater in height with storage capacities of 15 acre-feet or more. The program requires inspections every five and three years for low and significant hazard structures, respectively. It requires annual inspection of the State's high-hazard dams, so designated due to the presence of one or more habitable structures downstream with loss of life and flooding likely to occur if a dam were to fail.

Creek County has nine high hazard dams and four significant hazard dams that could possibly put people and structures at risk, but there is no recorded history of dam failure in the County since 1950. Flooding potential exists if dam failure should occur at these high hazard dams. These dams provide source water for public water systems. If a failure occurred, the potential exists to have thousands of people, pets, and livestock would have a greatly reduced water supply for a long period of time. Obviously the impact of this would be devastating and many people would have to relocate to carry on normal lives. Disruption to businesses and schools would be enormous. The economic impact of such an event would be impossible to predict.

The initial hazard classifications are based upon current conditions, including population and land-use patterns below the dams. Such conditions can shift over time, such that a structure that is not considered high-hazard may receive such designation in the future, should, for example, dwellings be built within the floodplain below the dam. Other high-hazard dams may have such designation lowered should land-use patterns change, reducing the threat of loss to life or property. Mitigation aspects, such as relocations of vulnerable properties, can reduce the number and magnitude of high-hazard dams. To protect vulnerable populations the State of Oklahoma and Creek County, the following law is in place:

State Law 785:25-7. Warning and evacuation plans.

- Owners of existing or proposed dams classified as high hazard, regardless of the size of such dams, and any other dam as determined by the Board, shall provide an adequate warning system and written evacuation plan to protect downstream lives and property, with a written description of said system and written evacuation plan to be approved by and filed with the local Civil Defense authorities.
- Additionally, the written description of the warning system and approved evacuation plan shall be filed with the Board.

3.3 Assessing Vulnerability: Identifying Assets

This section describes vulnerability in terms of the type and number of existing buildings and critical facilities in the hazard location. The vulnerability analysis utilized FEMA publication 386-2, "Understanding Your Risks," Step 3, in order to determine the building value and contents value to determine a total value per building at risk from the hazard.

The Creek County Assessor classifies properties into three (3) types; residential, commercial, and agricultural. A value for each property with a structure was determined by the assessor. The contents value was determined as a percentage of the building value, based on the Contents Value table in FEMA 386-2, Step 3.

The following table shows this information for all buildings in Creek County. This table will be referred to for all hazards that do not vary by location throughout the county.

Table 3-15
TOTAL BUILDINGS IN COUNTY

Category	Number of Structures	Structure Value ($$)
Residential	20,649	1,289,255,092
Commercial	1384	309,410,433
Agricultural	2738	158,383,283
Total	24,816	1,757,048,808

Flood hazards, dam break hazards, and hazards from expansive soils are the only three hazards that vary in magnitude in a pre-determined location. A hypothetical tornado was analyzed in the tornado hazard section. For these hazards, GIS models were used to determine the buildings in a hazard location.

For each hazard, the assets (buildings) at risk from that hazard are tabularized in each hazard's section, or referred to the above table. The total number of buildings at risk, the building type, the building value, its contents value, and the total value is shown. These tables follow the format in FEMA 386-2, worksheets 3a "Inventory Assets".

This assessment also analyses the critical facilities at risk from each hazard. Where a hazard varies by location, these facilities' locations are shown in relation to the hazard on a separate map. Information on mobile homes is not tracked by the Creek County Assessor; therefore, it is not included in the Creek County vulnerability assessment.

Facilities that are classified to be critical by Creek County are listed in the following table, and shown on Map Number 4 in Appendix 1. These facilities are critical to the County in they provide public safety and emergency response services to the public in the event of a hazard occurrence or they are necessary to preserve welfare and quality of life to the community.

Table 3-16
COUNTY CRITICAL FACILITIES

TYPE	NAME	ADDRESS	CITY
City Government	City of Bristow City Hall	110 W 7th St	Bristow
	Town of Depew Town Hall	407 E Main	Depew
	City of Drumright City Hall	122 W Broadway	Drumright
	Town of Kellyville Town Hall	410 E Buffalo	Kellyville
	Town of Kiefer Town Hall	401 E Indiana	Kiefer
	City of Mannford City Hall	300 Coonrod	Mannford
	City of Oilton City Hall	101 W Main	Oilton
	Town of Mounds Town Hall	1319 Commercial	Mounds
County Govt	Creek County Courthouse	222 E Dewey	Sapulpa
	Creek County Assessor	317 E Lee	Sapulpa
	Creek County Emergency Mgmt	10 S Oak	Sapulpa
Fire Department	City of Bristow Fire Department	115 E 6th St	Bristow
	Town of Depew Fire Department	205 W Main	Depew
	City of Drumright Fire Department	120 W Broadway	Drumright
	Town of Kellyville Fire Dept	422 E Buffalo	Kellyville
	Town of Kiefer Fire Department	399 E Indiana	Kiefer
	City of Mannford Fire Department		Mannford
	City of Oilton Fire Department	201 E Main	Oilton
	Town of Mounds Fire Department	300 Commercial	Mounds
Police Department	Bristow Police Department	108 W 7th St	Bristow
	Drumright Police Department	124 W Broadway	Drumright
	Kellyville Police Department	410 E Buffalo	Kellyville
	Kiefer Police Department		Kiefer
	Mannford Police Department	302 Coonrod	Mannford
	Oilton Police Department	101 W Main	Oilton
	Mounds Police Department	1319 Commercial	Mounds
Water/Wastewater Facility	Bristow Water		Bristow
	Bristow Wastewater		Bristow
	Depew Wastewater Facility		Depew
	Drumright Water		Drumright
	Drumright Wastewater		Drumright
	Kellyville Wastewater		Kellyville
	Kiefer Wastewater		Kiefer
	Mannford Water		Mannford
	Mannford Wastewater		Mannford
	Oilton Wastewater		Oilton
	Mounds Wastewater		Mounds

Electric	Keystone Dam Generation Facility		Mannford
School	Allen-Bowden Schools, 2 sites	7049 Frankoma Rd	Tulsa
	Bristow Schools, 5 sites	420 N Main	Bristow
	Depew Schools, 3 sites	PO Box 257	Depew
	Drumright Schools, 4 sites	301 S Pennsylvania	Drumright
	Gypsy Schools, 1 site	30599 S 417 W Ave	Depew
	Kellyville Schools, 4 sites	PO Box 99	Kellyville
	Kiefer Schools, 4 sites	4600 W 151 St	Kiefer
	Mannford Schools, 6 sites	136 Evans Ave	Mannford
	Milfay Schools, 3 sites	PO Box 219	Milfay
	Mounds Schools, 2 sites	PO Box 189	Mounds
	Oilton Schools, 3 sites	PO Box 130	Oilton
	Olive Schools, 3 sites	9352 S 436 W Ave	Drumright
	Pretty Water Schools, 1 site	15223 W 81 St	Sapulpa
Child Care	Bristow Head Start II	1002 S CHESTNUT	Bristow
	Home Alone Kids Club	122 W 10	Bristow
	Tendercare Learning Ctr	715 Country Club Dr	Bristow
	Lisa's Day Care	301 E. STINER	Drumright
	Sims, Debra Child Care Home	202 N SKINNER	Drumright
	Kellyville Elementary Extended	144 S ELM	Kellyville
	Little Troopers, Inc.	225 E MARLEY	Kellyville
	Sims, Brittany Child Care Home	202 S. Pine Street	Kellyville
	Talley, Jennifer Child Care Home	8 S. Main	Kellyville
	Anderson, Barbara Child Care Home	16 N JANETTE	Kiefer
	Claudio, Jasmin Child Care Home	115 DP NEWMAN Cir	Kiefer
	Buttons & Bows	42 BASIN ROAD	Mannford
	Byrd, Shannon Child Care Home	140 Lakeview Dr.	Mannford
	Day, Rebecca Child Care Home	1609 HILLSIDE DR.	Mannford
	Lakeside Child Development Ce	110 EVANS AVE	Mannford
	Lee, Dianna Child Care Home	5760 S HWY 48	Mannford
	Baird, Brenda Lee Child Care Home	4561 W. 187th St.	Mounds
	Leffler, Leisa Kay Child Care Home	110 E 15TH ST	Mounds
	Wynn, Sharon Kaye Child Care Home	1406 COMMERCIAL	Mounds
	Oilton Head Start	306 E PETERSON	Oilton
	Couch, Kimberly Child Care Home	123 S Poplar	Sapulpa
	Creek Nation Sapulpa Child De	1020A N. BROWN ST	Sapulpa
	Farmer, Jeanna Lee Child Care Home	17035 S 141st W Ave	Sapulpa
	Hose, Barbara Child Care Home	523 POPLAR STREET	Sapulpa
Hospitals	Drumright	610 W Truck Bypass	Drumright
	Sapulpa	1004 W Bryan	Sapulpa
	Bristow	700 W 7th St	Bristow

Elderly Care	Arbor Village Nursing Home	310 W Taft	Sapulpa
	Cimarron Pointe Care Center	404 E Cimarron	Mannford
	Drumright Nursing Home	701 N Bristow	Drumright
	The Gardens Nursing Home	1165 Brenner Rd	Sapulpa
	Northside Nursing Home	102 E Line	Sapulpa
	Rainbow Health Care Center	111 E Washington	Sapulpa
	Ranch Terrace Nursing Home	1310 E Cleveland	Sapulpa

3.3.1 Flood Hazard

There are five repetitive loss structures in the Creek County that are insured through the National Flood Insurance Program. Damaged structures are rebuilt in conformance with the County's, or respective community's flood damage prevention ordinance. As grants funds become available, the regulating jurisdiction is working with the property owner to remove the structure from the floodplain. For all structures at risk from a flood hazard, those buildings on property intersecting the regulatory floodplain is summarized below.

Table 3-17
TOTAL BUILDINGS IN REGULATORY FLOODPLAIN

	Number of Buildings	Building Value ($$)	Contents Value ($$)	Total Value ($$)
Residential	1647	111,380,075	55,690,038	167,070,113
Commercial	111	77,678,758	77,678,758	155,357,516
Agricultural	953	50,890,200	50,890,200	101,780,400
Total	2711	239,949,033	184,258,996	424,208,029

Map Number 12 in Appendix 1 also shows the location of the critical facilities in relation to the flood hazard. There are three critical facilities located on property intersecting the regulatory floodplain.

Any future building in a flood hazard will be built in conformance with the County's Flood Damage Prevention Ordinance as part of the County's membership in the NFIP; therefore, future buildings will not be considered by FEMA as at risk from the regulatory floodplain. The same will be for each Creek County community participating in the plan update, as they are also members of the NFIP.

3.3.2 Tornado Hazard

In Creek County, the City of Drumright was hit by an F-4 tornado on June 8, 1974. The path of the tornado is shown on Map Number 13 in Appendix 1. It was reported to have done substantial damage to all structures in a quarter-mile width along its path. To illustrate the structures at risk if this tornado occurred today, the current buildings within this tornado's path of destruction were determined and their building, contents, and total value were estimated. This estimate is shown in the following table.

Table 3-18
BUILDINGS IN TORNADO SCENARIO

Type	Number of Buildings	Building Value ($$)	Contents Value ($$)	Total Value ($$)
Residential	140	8,149,708	1,074,854	12,224,562
Commercial	8	2,271,425	2,271,425	4,542,850
Agricultural	1	27,092	40,638	67,730
Total	149	10,448,225	6,386,917	16,835,142

The critical facilities are also shown on Map Number 13; there are three facilities within this tornado path.

3.3.3 Dam Break Hazard

For the structures at risk from a dam break hazard, those buildings on property intersecting the 500-year floodplain downstream of each lake is summarized below. Because of the large drainage areas upstream of most of the dams identified in section 3.2.13, the Creek County Floodplain Administrator determined the impact of the dam break inundation area downstream of most of the dams would be greater than the regulatory floodplain. Therefore, Parthenia Lake Dam, Sapulpa Lake Dam, Sahoma Lake Dam, the SCS Dams at Sites 12, 33, 36, 15, and 28, Lake Massena Dam, Mannford Lake Dam, Boren Dam, no-name dam number 037071, and the Heyburn Lake Dam were determined to pose a larger hazard in a dam break scenario than the regulatory flood. Map Number 14 shows this estimated area of inundation by the dam break hazard.

Table 3-19
BUILDINGS IN DAM BREAK (500-YEAR FLOODPLAIN) INUNDATION AREA

Type	Number of Buildings	Building Value ($$)	Contents Value ($$)	Total Value ($$
Residential	1,034	47,497,283	23,748,642	71,245,925
Commercial	86	19,685,925	19,685,925	39,371,850
Agricultural	768	15,966,608	15,966,608	31,933,216
Total	2,197	83,149,816	59,401,175	142,550,991

Map Number 14 in Appendix 1 also shows the location of the critical facilities in relation to the dam break hazard. There are three critical facilities in this dam break area of inundation.

3.3.4 High Wind Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.5 Lightning Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.6 Hail Storm Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.7 Winter Storm Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.8 Heat Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.9 Drought Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section.

3.3.10 Expansive Soils Hazard

The properties at risk from this hazard are properties located on high and very high shrink-swell potential soil types. The locations of expansive soils are shown in Map Number 7 in Appendix 1. As discussed in the profile of the expansive soil hazard in Creek County, the soil information is stored in raster type data. A spatial analysis to determine the number of properties and buildings at risk from high and very high shrink-swell potential soil cannot be preformed. However, the general location of properties at risk from expansive soils hazard is shown on Map 7 in Appendix 1. Generally, these are in the western part of the county.

There is no need to address expansive soils in this plan due to the lack of data related to damage and there is no justification for mitigating vulnerabilities. Vulnerabilities include structures with foundations such as homes and businesses, concrete slabs in driveways and sidewalks, and parking lots. Asphalt surfaces such as highways and runways could be affected.

3.3.11 Wildfire Hazard

All areas, and all buildings, in the County are at equal risk from being impacted by this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. Fires can also destroy non structural assets such as agriculture, vegetation, and vehicles. Vulnerability of these non-structural assets, both in identifying these assets and estimating their damage potential was not quantified.

3.3.12 Earthquake Hazard

All areas, and all buildings, in the County are at equal risk from this hazard. The total number of buildings, and value, in the County is shown in the table at the beginning of this section. There is no need to address earthquakes in this plan because the infrequent events do not justify mitigating vulnerabilities. Vulnerabilities include all structures, homes, businesses and transportation infrastructure.

3.3.13 Hazardous Material Hazard

The public is most at risk from hazardous materials when they are being transported. The County has defined the major transportation routes and are shown in Map Number 15 in Appendix 1.

3.4 Assessing Vulnerability: Estimating Potential Losses

For each hazard, an analysis was done to determine the potential dollar losses to vulnerable buildings identified in Section 3.3. The analysis followed the methodology discussed in FEMA 386-2, step 4, and the format of FEMA 386-2 worksheet #4 "Estimate Losses".

Only the flood hazard, dam break hazard, and the hypothetical tornado analyses identified structures with varying amounts of damage.

3.4.1 Flood Hazard

For the flood hazard, for this planning exercise, all structures on property intersecting the regulatory floodplain are evaluated at one foot below the base flood elevation. (Actual first floor elevations were not surveyed and the best available topography has 10 foot contour intervals making windshield surveys plus and minus five feet.) Using FEMA 386-2, part 4, building damage with one foot of flood depth is estimated to be 14 percent of the building value, and content damage is estimated to be 21 percent of the building value.

Table 3-20
DAMAGE ESTIMATE WITH ONE-FOOT FLOOD DEPTH

Type	Number of Buildings	Building Value ($$)	Building Damage Value ($$)	Contents Damage Value ($$)	Total Damage Value ($$)
Residential	1647	111,380,075	15,593,211	11,694,908	27,288,118
Commercial	111	77,678,758	10,875,026	16,312,539	27,187,565
Agricultural	953	50,890,200	7,124,628	10,686,942	17,811,570
Total	2711	239,949,033	33,592,865	38,694,389	72,287,254

3.4.2 Tornado Hazard

For the tornado hazard analysis, the path and impact area of the F-4 tornado to hit the City of Drumright in 1974 is depicted in Map Number 13 in Appendix 1. As discussed in Section 3.3.2, the current buildings at risk from this tornado were determined. The FEMA 386-2 literature states there are no standard loss estimation models and tables for tornados. Therefore, all buildings within this tornado's impact area were estimated to be completely destroyed. The potential loss from this tornado today is shown in the following table.

Table 3-21
TOTAL BUILDINGS IN TORNADO SCENARIO

Type	Number of Buildings	Building Value ($$)	Contents Value ($$)	Total Value ($$)
Residential	140	8,149,708	1,074,854	12,224,562
Commercial	8	2,271,425	2,271,425	4,542,850
Agricultural	1	27,092	40,638	67,730
Total	149	10,448,225	6,386,917	16,835,142

3.4.3 Dam Break Hazard

For the dam break hazard, for this planning exercise, all structures on property intersecting the hazard location were evaluated at two feet below the water elevation. (Actual first floor elevations were not surveyed and the best available topography has 10 foot contour intervals making windshield surveys plus and minus five feet.) This is one foot more than the vulnerability analysis for the flood hazard because the hazard from a dam break could occur as a surge of water rather than just rising water; therefore, it could cause more damage and that is accounted for in the greater damage estimate percentages for two feet deep. Using FEMA 386-2, part 4, building damage with two feet of flood depth is estimated to be 22 percent of the building value, and content damage is estimated to be 33 percent of the building value.

Table 3-22
DAMAGE ESTIMATE WITH TWO-FEET FLOODING DEPTH

Type	Number of Buildings	Building Value ($$)	Building Damage Value ($$)	Contents Damage Value ($$)	Total Damage Value ($$)
Residential	1,034	47,497,283	10,449,402	7,837,052	18,286,454
Commercial	86	19,685,925	4,330,904	6,496,355	10,827,259
Agricultural	768	15,966,608	3,512,654	5,268,981	8,781,634
Total	2,197	83,149,816	18,292,960	19,602,388	37,895,347

3.4.4 Hazardous Material Hazard

The locations of the critical facilities in relation to the hazardous material locations and the major transportation routes are shown in Map Number 16 in Appendix 1.

3.4.5 Expansive Soils

The potential damage to structures and infrastructure located on high and very high shrink-swell potential soils is dependant on the design of its foundation and quality of the construction of the foundation. Both factors were beyond the scope of this multi-hazard mitigation plan. Set damage estimates based on a percentage of the structure value were not used because of the wide variation of the factors involved in a foundation's stability. There is no need to address expansive soils in this plan due to the lack of data related to damage and there is no justification for mitigating vulnerabilities. Vulnerabilities include structures with foundations such as homes and businesses, concrete slabs in driveways and sidewalks, and parking lots. Asphalt surfaces such as highways and runways could be affected.

3.4.6 All Other Hazards

The magnitude of the damage to structures from all the other hazards does not vary by location. The total building and content value for all structures in County is totaled and shown in the table in the beginning of Section 3.3.

3.5 Assessing Vulnerability: Analyzing Development Trends

This section discusses the community's vulnerability in terms of a general description of land use and development trends so that mitigation options can be considered in future land use decisions. Three areas were analyzed. These are the types of existing and proposed land uses, development densities in the hazard areas, and anticipated changes in land use

3.5.1 The Creek County Assessor assigns three land use categories for the county. These are residential, commercial, and agricultural. Land use changes can occur, and are initiated by the property owner, usually to accommodate a new development. The County's Board of Adjustment reviews each change request, and takes into account hazards and hazard prone areas in ruling on any land use change request.

3.5.2 There are 43,005 parcels of property in County. Of these, 18,189 parcels are undeveloped. And of these 18,819 undeveloped parcels, 3737 are in the regulatory floodplain; 1130 residential, 65 commercial, and 1794 agricultural. Map Number 17 in Appendix 1 shows this information. It must be noted that no new building development will be added to the flood hazard because any new building will conform to the County's Flood Damage Prevention Ordinance, which the County will continue to vigorously enforce. It will be recommended to all new construction to investigate the shrink-swell potential of its soils, and design and construct the foundation with the soils' properties as a consideration.

3.5.3 Anticipated changes in land use, i.e., new subdivision development, are expected to occur in and around Sapulpa and in the northeast corner of the County adjacent to the City of Tulsa. It is not anticipated the smaller communities will have significant development in the short term, however infill development will continue; utilizing existing infrastructure within the community.

Chapter 4:

Mitigation Strategies

This chapter identifies the hazard mitigation goals set by Creek County and the participating jurisdictions, and discusses the mitigation projects or measures to be taken to achieve those goals.

4.1 Hazard Mitigation Goals

4.1.1 Mission Statement

To create a disaster-resistant community and improve the safety and well-being of the citizens of Creek County by reducing deaths, injuries, property damage, environmental losses, and other losses from natural and technological hazards in a manner that advances community goals, quality of life, and results in a more livable, viable, and sustainable community.

The mission statement and goals were determined by the committee at their initial meetings. Specific objectives were developed during the risk assessment phase and evaluated again as potential action steps were considered.

4.1.2 Specific Goals and Objectives

Goal 1 General: To protect vulnerable populations and critical facilities from hazards.

Objectives:

1. Minimize the loss of life and damage to property and infrastructure from natural and man-made disasters.
2. Increase public awareness of risks from hazards and implement measures that can be taken to protect families and property from disasters.
3. Reduce the risk and effects of hazards and minimize disruption in the county.
4. Identify and protect vulnerable populations from natural and man-made hazards.
5. Identify and protect critical county and community facilities from hazards so that they can continue their missions in the event of a disaster.

Goal 2 Flood Hazard: To reduce the risk of flood hazard in Creek County.

Objectives:

1. Identify buildings at risk from the 100-year regulatory flood.
2. Ensure that development does not increase flooding downstream or have off-site adverse impacts.
3. Identify and maximize the natural and beneficial uses of the floodplain.
4. Implement the best flood control measures to reduce vulnerability of flood-prone properties.

Goal 3 Tornado Hazard: To reduce the risk from tornados in Creek County

Objectives:

1. Encourage building of individual safe rooms and storm shelters.
2. Educate and encourage the building trades industry about construction standards that are adequate to withstand frequent high winds.

Goal 4 Hailstorm Hazard: To reduce the risk from hailstorms in Creek County.

Objectives:

1. Promote construction of hail resistant roofs.

Goal 5 Lightning Hazard: To reduce the risk from lightning in Creek County.

Objectives:

1. Reduce loss of life and property, and injury due to lightning by increased public awareness of measures to prevent and reduce damage, including warnings.

Goal 6 Winter Storm Hazard: To reduce the hazards from winter storms in Creek County.

Objectives:

1. Reduce property loss and community disruption due to severe winter cold and ice storms.

Goal 7 High Winds Hazard: To reduce the risk from high winds in Creek County.

Objectives:

1 Educate and encourage the building trades industry about construction standards that are adequate to withstand frequent high winds.

Goal 8 Drought Hazard: Reduce the economic impact of drought hazards to Creek County.

Objectives:

1. Reduce damage to property and building foundations due to drought by improving building codes.

Goal 9 Wildfire Hazard: To reduce the threat of wildfire hazards and their financial impact in Creek County.

Objectives:

1. Develop a County-wide fire response and support group to facilitate the provisioning of water to fires during large fires.

Goal 10 Expansive Soil Hazard: Reduce structure's susceptibility to soil movement.

Objectives:

1. Reduce damage to property and building foundations due to expansive soils by improving building codes.

Goal 11 Earthquake Hazard: To reduce the risk from earthquakes in Creek County.

Objectives:

1. Educate and encourage the building trades industry about earthquake resistant construction.

Goal 12 Hazardous Materials Hazard: To reduce the risk from hazardous material storage facilities around Creek County.

Objectives:

1. Protect the public from exposure from hazardous materials events from sites within the community.

Goal 13 Dam Break Hazard: To reduce the risk of a dam break hazard in Creek County.

Objectives:

1. Identify dams that could impact the county.
2. Identify areas at risk.

Goal 14 Extreme Heat: To reduce the risk from extreme heat in Creek County.

Objectives:

1. Lessen injury and potential loss of life to citizens during periods of extreme heat through education.

4.2 Mitigation Categories

There are several types of measures that communities and individuals can use to protect themselves from, or mitigate the impacts of, natural and man-made hazards. Mitigation measures, for purposes of this study, fall into the following categories:

Preventive Measures
Structural Projects
Property Protection
Emergency Services
Public Information and Education

4.2.1 Preventive Measures

Preventive measures are designed to keep certain conditions from occurring or getting worse. The objective is to ensure that **new** development does not increase damages or loss of life, and that new construction is protected from those hazards. Preventive measures are usually administered by building, zoning, planning, and code enforcement offices. They typically include planning, zoning, building codes, and floodplain development regulations and storm water management.

The first two measures, planning and zoning, work to keep damage-prone development out of the hazardous or sensitive areas. Comprehensive Plan's prepared by communities in Creek County identify areas that are sensitive to urban development. Zoning Ordinance's in Creek County regulates development by dividing the county and communities into zones or districts and setting development criteria for each zone or district. A zoning ordinance is considered the primary tool to implement the comprehensive plan's guidelines for how land should be developed.

The next two measures, floodplain development regulations and storm water management. Creek participates in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for subdivision regulations and building codes. Storm water management regulations require developers to mitigate any increase in runoff due to their development. Building codes require a level of new construction standards for new building construction.

4.2.1.1 Preventative Activities

- Planning and zoning help Creek County and communities in the county develop proactively so that the resulting infrastructure is laid out in a coherent and safe manner.
- Building codes for foundations, sprinkler systems, masonry, and structural elements such as roofs and the exterior building envelope are prime mitigation measures for occurrences of floods, tornadoes, high winds, extreme heat and cold, and earthquakes.

- Participation in the NFIP and using floodplain ordinances and subdivision regulations to regulate floodplain development is beneficial for Creek County and communities in the county.
- Tree trimming adjacent to overhead power lines and placing new lines underground would help in preventing power outages during winter ice storms.
- Better information about hazardous materials in, and being transported through the County is desired for safety and contingency planning.

4.2.2 Structural Projects

Structural projects are usually designed by engineers or architects, constructed by both the public and private sector, and maintained and managed by governmental entities. Structural projects traditionally include storm water detention reservoirs, levees and floodwalls, channel modifications, and drainage and storm sewer improvements.

4.2.2.1 Structural Activities

- Crossing and roadway drainage improvements must take into account additional detention or run-off reduction.
- Drainage and storm sewer improvements carry runoff from smaller, more frequent storms.
- Drainage system maintenance is an ongoing project of removing debris that decreases the effectiveness of detention ponds, channels, ditches, and culverts.

4.2.3 Property Protection Measures

Property protection measures are used to modify **existing** buildings or property subject to damage from various hazardous events. Property protection measures are normally implemented by the property owner. However, in some cases, technical and financial assistance can be provided by a governmental agency. Property protection measures from flooding typically include acquisition and relocation, flood-proofing, building elevation, and barriers. Property protection measures from other natural hazards include retrofitting, reinforced foundations, enhanced building codes with emphasis on the exterior building envelope, anchoring of roof and foundation, installation of safe rooms, hail resistant roofing, and insurance.

4.2.3.1 Property Protection Activities

Floods
- Dry flood proofing (making walls watertight so floodwaters cannot get inside)
- Wet flood proofing (letting the water in and removing everything that could be damaged by a flood)
- Installing drain plugs, standpipes or backflow valves to stop sewer backup

Tornado
- Constructing an underground shelter or in-building “safe room”
- Securing roofs, walls and foundations with adequate fasteners or tie downs
- Strengthening garage doors and other large openings

High Winds
- Installing storm shutters and storm windows
- Burying utility lines

- Installing/incorporating backup power
- supplies

Hailstorms

- Installing hail resistant roofing materials

Lightning

- Installing lightning rods and lightning surge interrupters
- Burying utility lines
- Installing/incorporating backup power supplies

Winter Storms

- Adding insulation
- Relocating water lines from outside walls to interior spaces
- Sealing windows
- Burying utility lines
- Installing/incorporating backup power supplies

Extreme Heat and Drought

- Adding insulation
- Installing water saver appliances, such as shower heads and toilets

Wild Fires

- Replacing wood shingles with fire resistant roofing
- Adding spark arrestors on chimneys
- Landscaping to keep bushes and trees away from structures
- Installing sprinkler systems
- Installing smoke alarms

General Measures

From the above lists, it can be seen that certain approaches can help protect from more than one hazard. These include:

- Strengthening roofs and walls to protect from wind and earthquake forces
- Bolting or tying walls to the foundation protect from wind and earthquake forces
- and the effects of buoyancy during a flood
- Adding insulation to protect for extreme heat and cold
- Anchoring water heaters and tanks to protect from ground shaking and flotation
- Burying utility lines to protect from wind, ice and snow
- Installing backup power systems for power losses during storms
- Installing roofing that is hail resistant and fireproof

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program (NFIP). Flood insurance coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area.

4.2.4 Emergency Service Measures

Emergency services measures protect people during and after a hazard event. Locally, these measures are coordinated by the emergency management agencies of the individual communities. Measures include preparedness, threat recognition, warning, response, critical facilities protection, and post-disaster recovery and mitigation.

Threat recognition is the key. The first step in responding to a flood, tornado, storm or other natural hazard is knowing that one is coming. Without a proper and timely threat recognition system, adequate warnings cannot be disseminated.

After the threat recognition system tells municipal police departments and/or Creek County Emergency Management Agency that a hazard is coming, the next step is to notify, **or warn**, the public and staff of other agencies and critical facilities. The following are the more common warning media:

- Outdoor warning sirens
- Sirens on public safety vehicles
- NOAA Weather Radio
- Commercial or public radio or TV stations
- Cable TV emergency news inserts
- Telephone trees
- Door-to-door contact
- Mobile public address systems

Just as important as issuing a warning is telling people what to do. A warning program should have a public information aspect. People need to know the difference between a tornado warning (when they should seek shelter in a basement) and a flood warning (when they should stay out of basements).

4.2.4.1 Emergency Services Activities

The protection of life and property is the foremost important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

Response Activities

- Activating the emergency operations room (Emergency Management)
- Closing streets or bridges (Sheriff/Police/County or Public Works)
- Shutting off power to threatened areas (OG&E/AEP/City and Rural Co-ops)
- Holding children at school/releasing children from school (School District)
- Passing out sand and sandbags (County or Public Works)
- Ordering an evacuation (Commission Chairman or Mayor)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (County or Public Works)
- Security and other protection measures (Sheriff or Police)

After a disaster, communities should undertake activities to protect public health and safety, facilitate recovery, and prepare people and property for the next disaster. This is commonly referred to as Post-Disaster Recovery and Mitigation.

Recovery Activities

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Monitoring for diseases
- Vaccinating residents for tetanus
- Clearing streets
- Cleaning up debris and garbage

- Regulating reconstruction to ensure that it meets all code requirements, including the NFIP's substantial damage regulations

Mitigation Activities

- Conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long term mitigation activities
- Applying for post-disaster mitigation funds

Overall Emergency Service Activities

- Using solid, dependable threat recognition systems is first and foremost in emergency services.
- Following a threat recognition, multiple or redundant warning systems and instructions for action are most effective in protecting citizens.
- Good emergency response plans that are updated yearly ensure that well-trained and experienced people can quickly take the appropriate measures to protect citizens and property.
- To ensure effective emergency response, critical facilities protection must be part of the plan.
- Post-disaster recovery activities include providing neighborhood security, safe drinking water, appropriate vaccinations, and cleanup and regulated reconstruction.

4.2.5 Public Information and Education Measures

Successful public information and education measures involve both public and private sectors. Public information and education activities advise and educate citizens, property owners, renters, businesses, and local officials about hazards and ways to protect people and property from them. Public information activities are among the least expensive mitigation measures, and at the same time are often the most effective thing a community can do to save lives and property. All mitigation activities begin with public information and education.

Many benefits stem from providing map information to inquirers. Residents and businesses that are aware of the potential hazards can take steps to avoid problems and reduce their exposure to flooding, dam failure or releases, hazardous materials events, and other hazards that have a geographical distribution. These mapped hazards are included in this Hazard Mitigation study, and are discussed below. Flood Insurance Rate Maps (FIRMS) and Flood Hazard Boundary maps are available to show the flood zones for each property. Flood insurance is always recommended for those properties subject to flooding, especially for those in Flood Zone A.

Hazardous materials sites, listed in the Oklahoma Department of Environmental Quality's EHS list, are shown on Map Number 10 in Appendix 1, and are listed in Section 3.2.12. Transportation routes frequently used in the transport of hazardous materials include US Highway 60, State Highway (SH) 10, SH 11, SH 18, SH 20, SH 97, SH 99 and SH 123. There are no railroads currently within the county. High-pressure pipeline locations have been suppressed by the Federal government since 9/11.

Public Libraries located in the county are a place for residents to seek information on hazards, hazard protection, and protecting natural resources. Historically, libraries have been the first place people turn to when they want to research a topic. Interested property owners can read or

check out handbooks or other publications that cover their situation. The libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.

4.2.5.1 Public Information and Education Activities

- There are many ways that public information programs can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves.
- Most public information activities can be used to advise people about all hazards, not just floods.
- Other public information activities require coordination with other organizations, such as schools and real estate agents.
- There are several area organizations that can provide support for public information and educational programs.

4.3 Research, Review, and Prioritization

A wide range of literature searches and other sources were researched to identify mitigation measures for each hazard. Measures were identified to ascertain those that were most appropriate for Creek County. The public involvement process included a citizen hazard mitigation questionnaire. 104 responses were received. The survey and summary of the responses are included in Appendix 4. The public involvement process also included holding open meetings for all committee meetings; and a public hearing at the March 29, 2012 committee meeting. A list of potential mitigation measures was prepared by staff and presented to the committee to stimulate debate and discussion.

The committee reviewed the mitigation activities. The committee incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities. While not referred to by name at the time of the mitigation activity review, the intent of the method was used. An explanation of each STAPLE+E criteria item is as follows:

S: Social	Mitigations actions are acceptable to the county if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the county's social and cultural values.
T: Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A: Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P: Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L: Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E: Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective before an action is implemented.
E: Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with environmental regulations, and that are consistent with the county's environmental goals, have mitigation benefits while being environmentally sound.

Among the factors discussed for each activity was its economic impact on the county. A cost-benefit analysis was not done for each activity under consideration, but the committee decided to have a formal cost-benefit evaluation done for any selected activity that would follow the requirements of the funding source when funds are being sought and the CCEMAC would look for actions with a benefit greater than its cost.

While the committee did not select projects for each jurisdiction, it did offer recommendations. Creek County, and each participating jurisdiction, selected their own mitigation actions, with the criteria as outlined in this section

The potential social impact, implementation capabilities (county work force), and potential funding availability for each activity, and the other STAPLE+E criteria principles were considered in prioritizing the activities. The County's action plan will take into the above factors and include at least two projects for each hazard.

Chapter 5:

Action Plan

Creek County has again reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. The County also reviewed the list of recommended actions or projects the County included in the previous plan to identify actions that had been completed, and what other actions should be continued, deferred, or cancelled. The results of this review are included in table 5.1 below.

Table 5.1
Status of Mitigation Measures from Previous Plan

Action Plan #	Action Description	Progress on Action	Recommendation for the Action
1	Complete 911 addressing for all of the County	started	continue
2	Develop specific ideas for educating the public and businesses about hazards that can affect them, and methods of preparing for and minimizing the hazard event.	no progress	continue
3	Identify and plan for hazardous materials and incidents on major transportation routes through Creek County.	no progress	continue
4	Develop a countywide fire response and support group to facilitate the provisioning of water to fire departments during large fires.	no progress	continue
5	Build community partnerships involving local government leaders, civic, business and volunteer groups to work together.	started	continue
6	Acquire accurate or verify accuracy of existing flood plain maps and develop land use regulations to avoid construction in flood-prone locations.	continuing	continue
7	Inspect Creek County schools for tornado and high wind vulnerability.	no progress	continue
8	Construct adequate bridges to pass 100-year regulatory flood without overtopping.	started	continue
9	Investigate voluntary pilot demonstration projects for mobile home communities providing a shelter and/or safe rooms for residents.	started	continue
10	Acquire and remove Repetitive Loss Properties and repeatedly flooded properties where acquisition is the most cost effective and desirable mitigation measure.	started	continue

As part of the plan update process, this chapter identifies at least two (2) specific high priority actions per hazard to achieve the mitigation goals. Additional actions, number 11 through 25, were added. For each action, the hazard type it would be targeting is identified, the type of action is shown, the lead agency is identified, an anticipated time schedule and estimated cost is shown, identification of the possible funding sources are made, and the type of work product and

expected outcome is discussed. Once funding is sought, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source. The following table, Table 5.2, identifies which mitigation type project is associated with each hazard for Creek County.

Each participating jurisdiction prepared its own action plan by identifying their high priority mitigation actions or projects to that jurisdiction that the jurisdiction could undertake in the next five years to mitigate specific hazards. Each mitigation action included information on the same eight points as discussed in the previous paragraph.

The following table identifies which mitigation type project is associated with each hazard.

Table 5.2
Creek County Mitigation Actions or Activities per Hazard

Hazard Type	Creek County Mitigation Action Number
Flood	1, 6, 8, 10, 14, 19, 20, 24, 25
Tornado	1, 7, 19, 20, 24, 25
High Winds	1, 7, 19,20, 21, 24, 25
Lightning	1, 11, 19, 20, 24, 25
Hail	1, 19, 20, 21, 24, 25
Winter Storm	1, 16, 19, 20, 24, 25
Extreme Heat	1, 18, 19, 20, 21, 24, 25
Expansive Soils	1, 19, 20, 24, 25
Drought	1, 19, 20, 24, 25
Wildfire	1, 4, 19, 20, 22, 24, 25
Earthquake	1, 19, 20, 24, 25
Hazardous Material Events	1, 4, 19, 20, 24, 25
Dam Break	1, 19, 20, 24, 25

Creek County has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as was detailed in Section 4.3. Once funding is sought, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source. The County selected 24 mitigation activities to make up their Action Plan, at least two for each hazard, as follows.

1. Complete 911 addressing for all of Creek County.

Hazard Type: All Hazard
Project Type: Mitigation
Lead: Sheriff's Office and County IT Dept
Time Schedule: Ongoing
Estimated Cost: $10,000
Source of Funding: Local
Work Product: Establish and implement a system for the assignment of street names and numbering on houses in Creek County.
Expected Outcome: The system will retain a uniform systematic house numbering system throughout the County, which will promote continuity, avoid duplications, and eliminate house renumbering. This will also include 911 cell phone locations for E-911.

2. Develop specific ideas for educating the public and businesses about hazards that can affect them, and methods of preparing for and minimizing the hazard event.

Hazard Type: All Hazards
Project Type: Education
Lead: Emergency Management and Community Development Dept
Time Schedule: Ongoing
Estimated Cost: $7,500
Source of Funding: Local
Work Product: A plan for the distribution of hazard preparedness and mitigation literature as well as promoting demonstrations on prevention issues which seek to lessen the vulnerability of populations to natural hazards and hazardous material events.
Expected Outcome: Resources may include public broadcast, brochures, radio commercials, and newspaper articles to reach broad audiences and otherwise unknown but potentially impacted citizens.

3. Identify and plan for hazardous materials and incidents on major transportation routes through Creek County.

Hazard Type: Hazardous Materials
Project Type: Mitigation
Lead: Emergency Management and Sherriff's Dept
Time Schedule: Ongoing
Estimated Cost: $20,000
Source of Funding: Local
Work Product/Expected Outcome: Identify hazardous materials and the transportation systems used in their transport within the county; inventory 1) vulnerable populations in those areas 2) accessible fire and law enforcement resources useful for responding to hazardous material incidents.

4. Develop a countywide fire response and support group to facilitate the provisioning of water to fire departments during large fires.

Hazard Type: Wildfire
Project Type: Mitigation
Lead: Emergency Management Mutual Aid Fire Department
Time Schedule: Ongoing
Estimated Cost: $10,000
Source of Funding: Local
Work Product/Expected Outcome: Establish partnerships to aid in fire response coverage for all businesses and residents of Creek County currently, and for the foreseeable future.

5. Build community partnerships involving local government leaders, civic, business and volunteer groups to work together.

Hazard Type: All Hazards
Project Type: Education
Lead: Emergency Management
Time Schedule: Ongoing
Estimated Cost: $0.00
Source of Funding: Local
Work Product/Expected Outcome: A county with active contacts in government, business and volunteer services to aid in all areas of emergency response assistance and hazard preparedness.

6. Acquire accurate or verify accuracy of existing flood plain maps and develop land use ordinances to avoid construction in flood-prone locations.

Hazard Type: Flood
Project Type: Mitigation
Lead: Floodplain Manager
Time Schedule: Ongoing
Estimated Cost: $15,000
Source of Funding: Local
Work Product/Expected Outcome: Update existing floodplain maps with best available data and adopt ordinances that reflect a minimum standard of floodplain development such as standards to be met when participating in the NFIP.

7. Inspect Creek County schools for tornado and high wind vulnerability.

Hazard Type: Tornado, High Winds
Project Type: Mitigation
Lead: Emergency Management
Time Schedule: Ongoing
Estimated Cost: $5,000
Source of Funding: Local
Work Product/Expected: Outcome: Inventory buildings for areas susceptible to high winds and tornados, including status of roofs, windows, power lines, storm shelters, etc.

8. Construct adequate bridges to pass 100-year regulatory flood without overtopping.

Hazard Type: Flood
Project Type: Mitigation
Lead: Commissioners
Time Schedule: Ongoing
Estimated Cost: $5,000 (identify)
Source of Funding: Local
Work Product/Expected Outcome: Identify and then fund structural projects for bridges where 100-year flood events overtop the roadway; new construction which replaces older bridges should also be constructed according to 100-year flood stages.

9. Investigate voluntary pilot demonstration projects for mobile home communities providing a shelter and/or safe rooms for residents.

Hazard Type: Tornado
Project Type: Mitigation
Lead: Emergency Management
Time Schedule: Ongoing
Estimated Cost: $5,000
Source of Funding: Local
Work Product/Expected Outcome: Outcome: Install a tornado safe room with a capacity to hold all residents of the selected mobile home park Find creative sources of funding and materials such as abandoned railroad cars that are suitable for such a shelter.

10. Acquire and remove Repetitive Loss Properties and repeatedly flooded properties where acquisition is the most cost effective and desirable mitigation measure.

Hazard Type: Flood
Project Type: Mitigation
Lead: Floodplain Manager
Time Schedule: Ongoing
Estimated Cost: $2,500,000
Source of Funding: HMGP 75% federal; Local share 25%
Work Product: Acquisition and removal of all buildings from the floodplain.
Expected Outcome: Where acquisition is deemed to be the most cost-effective means of flood mitigation and protection.

11. Provide surge protection and uninterruptible power sources for electronic-reliant county facilities, such as the Sheriff Department, County Offices, and Emergency Operations Center.

Hazard Type: Lightning
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: FY2013-2017
Estimated Cost: $ 500 per unit and $20,000 for installation of generator per facility
Source of Funding: Local / Grants
Work Product: The work product will be electronic protection units to protect the electronic equipment in County facilities.
Expected Outcome: The expected outcome will be uninterrupted data retrieval from County facilities. With so much data and municipal records stored electronically, access to that data is vital to the continuous operation of government.

12. Develop a plan for Sheriff Department and Fire Department personnel to expand their knowledge and capabilities relative to hazardous materials and events, including meth labs. Also include public education on Meth Labs.

Hazard Type: Hazardous Materials
Project Type: Training
Lead: County Emergency Management
Time Schedule: FY2013, and annually
Estimated Cost: $10,000.00
Source of Funding: Local
Work Product: Training for emergency response personnel.
Expected Outcome: This will allow County personnel and personnel who respond to county emergencies to properly identify potentially hazardous situations, assess the magnitude and monitor the event until hazardous material response contractors arrive. Also include a public information campaign to educate the general public on how to identify Meth Labs.

13. Obtain funding for the distribution of educational materials on the hazards of extreme heat to vulnerable populations.

Hazard Type: Extreme Heat
Project Type: Education
Lead: County Emergency Management
Time Schedule: FY2013
Estimated Cost: $10,000.00
Source of Funding: Local / Grants
Work Product: Development of information on the hazards of extreme heat, in coordination with the State Emergency Management.
Expected Outcome: The expected outcome will be increased public awareness of the dangers of extreme heat. This information is targeted primarily vulnerable populations through agencies that work with these populations.

14. Upgrade the emergency communications network for fire, police, sheriff, 911, ambulance and other emergency operations.

Hazard Type: Flood, Tornado
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: FY2013-2017
Estimated Cost: $5,000,000.00
Source of Funding: Local / FEMA / Homeland Security
Work Product: Upgrade in communication equipment and to evaluate and possibly expand personnel dispatching coverage.
Expected Outcome: The outcome will be the ability to better disseminate information to response personnel and the public.

15. Develop a public information campaign to promote the advantages of individual fire suppression equipment in residences, including fire extinguishers.

Hazard Type: Wildfire
Project Type: Education
Lead: County Emergency Management
Time Schedule: FY2013-2015
Estimated Cost: $10,000.00
Source of Funding: Local / Grants
Work Product: Develop a public information campaign promoting individual fire suppression equipment in residences. This campaign would also include fire extinguishers.
Expected Outcome: The expected outcome will be increased fire protection for individual residences.

16. Update County equipment and vehicles for combating ice storm damage/adverse conditions to public infrastructure.

Hazard Type: Severe Winter Storm
Project Type: Mitigation
Lead: County Maintenance Department
Time Schedule: FY2013-2016
Estimated Cost: $ 10,000.00 (will utilize existing county vehicles)
Source of Funding: Local
Work Product: Acquisition of additional winter snow and ice equipment (plows and spreaders) for its existing vehicles to combat ice and winter storms.
Expected Outcome: Returning the infrastructure back to normal operations as quickly as possible after winter storms, ice and snow hazards, and all adverse conditions, is essential to hazard recovery, and is the expected outcome.

17. Educate the public about adequate building systems for resistance to tornados and high winds.

Hazard Type: Tornado, High Winds
Project Type: Education
Lead: County Emergency Management
Time Schedule: FY2013-2015
Estimated Cost: $10,000.00
Source of Funding: Local / Grants
Work Product: The development of educational materials on building systems to resist high wind hazards and tornados.
Expected Outcome: The expected outcome will be increased public awareness of building systems that are available to resist tornados and high wind hazards.

18. Install window air conditioners for elderly shut-ins for whom extreme heat can be a life threatening hazard.

Hazard Type: Extreme Heat
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: FY2013-2017
Estimated Cost: $50,000
Source of Funding: Local / Grants
Work Product: The work product is to develop non-profit oriented funding or county funding resources (or through donations) and the installation capability to meet the needs of elderly shut-ins and other vulnerable populations as needing assistance during extreme heat events.
Expected Outcome: The expected outcome is to reduce the number of persons who are exposed to heat as a life threatening hazard.

19. Hazard Occurrence Data Collection.

Hazard Type: All Hazards
Project Type: Mitigation
Lead: Creek County Emergency Management
Time Schedule: On-going when started
Estimated Cost: $10,000.00/year
Source of Funding: Local
Work Product: The work product will be a database of information about each future hazard occurrence.
Expected Outcome: The expected outcome will be good community specific information on the hazard that impact the County for future plan updates.

20. Public Information on Mitigation

Hazard Type: All Hazards
Project Type: Mitigation
Lead: Creek County Emergency Management
Time Schedule: FY2013-2014
Estimated Cost: $50,000.00
Source of Funding: Local/Grant
Work Product: The work product will be information on specific mitigation activities that the public can implement. In coordination with the State McReady Program.
Expected Outcome: The expected outcome will be more mitigation activities implemented by the residents of the County.

21. Window Laminates

Hazard Type: Hail, Heat, High Winds
Project Type: Mitigation
Lead: County Administration
Time Schedule: As funds become available
Estimated Cost: $50,000.00
Source of Funding: Local/Grant
Work Product: The work product would be installing laminates to all public buildings' windows.
Expected Outcome: The expected outcome will be a layer of protection from the hazards to prevent or lessen injuries to occupants of the buildings.

22. Establish fire breaks in the Wildfire urban interface.

Hazard Type: Wildfires
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: As funds become available
Estimated Cost: $1,000,000.00
Source of Funding: Grant
Work Product: The work product would be a fire resistant buffer around the incorporated parts of the County.
Expected Outcome: The expected outcome will be to minimize the area where wildfires can easily enter the urban areas of the County.

23. Engineering for a new County Maintenance Building and Emergency Operations Center

Hazard Type: All Hazards
Project Type: Preparation
Lead: County Administration, County Emergency Management
Time Schedule: FY2013
Estimated Cost: $31,000.00 for the engineering
Source of Funding: Local/Grant
Work Product: Prepare the site for the new county maintenance building for construction
Expected Outcome: This will complete the engineering necessary for the floodplain development application and building permits.

24. New Radio Repeater Towers

Hazard Type: All Hazards
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: FY2013
Estimated Cost: $30,000.00
Source of Funding: Local
Work Product: Construct new repeater towers throughout the County.
Expected Outcome: This will provide communication to CB radio operators, schools, and link county districts.

25. New Hand Held Narrow Band Radios

Hazard Type: All Hazards
Project Type: Mitigation
Lead: County Emergency Management
Time Schedule: FY2013
Estimated Cost: $35,000.00
Source of Funding: Local
Work Product: Acquisition and distribution of hand held narrow band radios.
Expected Outcome: This will meet new federal regulations for governmental and private groups on narrow band radios.

The City of Bristow has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigation activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. The City of Bristow selected six mitigation activities to make up their Action Plan, as follows.

1. Build an emergency operations center, located at the City Airport

Hazard Type: Floods, Tornado, High Winds, Hail, Winter Storm, Wildfires, Hazardous Material Events.
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $800,000.
Source of Funding: Local / Grants
Work Product: Construction of an emergency operations center.
Expected Outcome: A dedicated building to serve as an emergency operations center, completely outfitted, to serve all needs of emergency operations in one location.

2. Purchase and installation of equipment so City library can serve as a back-up emergency operations center.

Hazard Type: Floods, Tornado, High Winds, Hail, Winter Storm, Wildfires, Hazardous Material Events.
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $45,000.
Source of Funding: Local / Grants
Work Product: A back-up emergency operations center
Expected Outcome: Provide a second emergency operations center in the event the primary facility is unable to be used.

3. Outfit an existing trailer into a mobile emergency operations center.

Hazard Type: Floods, Tornado, High Winds, Hail, Winter Storm, Wildfires, Hazardous Material Events, Lightning.
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $35,000.
Source of Funding: Local / Grants
Work Product: A City of Bristow mobile emergency operations center
Expected Outcome: So the City is able to bring an emergency operations command post to the scene of a hazard.

4. Provide surge protection and uninterruptible power sources for electronic-reliant essential services of the City of Bristow, such as the Police Department, Fire Department, Emergency Operations Center, City Hall.

Hazard Type: Lightning
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $120,000.
Source of Funding: Local / Grants
Work Product: The work product will be electronic protection units to protect the electronic equipment in City facilities.
Expected Outcome: The expected outcome will be uninterrupted data retrieval from City essential services. With so much data and municipal records stored electronically, access to that data is vital to the continuous operation of government.

5. Replace two existing emergency warning sirens and add an additional siren.

Hazard Type: Floods, Tornados, High Winds, Winter Storms, Wildfires, Hazardous Material Events.
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $60,000.
Source of Funding: Local / Grants
Work Product: Emergency warning sirens.
Expected Outcome: Provide City with improved coverage for emergency warnings.

6. Purchase emergency services radios for the new Citizens Corporation Group (CCG) which is being forms in 2012.

Hazard Type: Floods, Tornados, High Winds, Lightning, Hailstorms, Severe Winter Storms, Extreme Heat, Drought, Wildfires, Earthquakes, Hazardous Materials Events.
Project Type: Mitigation
Lead: City
Time Schedule: FY2013
Estimated Cost: $33,000.
Source of Funding: Local / Grants
Work Product: Acquisition of emergency services radios.
Expected Outcome: To equip Citizens Corporation Group with communications equipment so the CCG can be in communication with City emergency responders.

The City of Drumright has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. Once funding is sought, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source. The City selected ten mitigation activities to make up their Action Plan, as follows.

1. Remove debris from floodway.

Hazard Type Flood
Project Type: Mitigation
Lead: City of Drumright
Time Schedule: FY 2013-2017
Estimated Cost: $100,000
Source of Funding: Local/Grant
Work Product: A floodway cleared of obvious debris so that the drainage ways flow more efficiently and therefore have more capacity.
Expected Outcome: The Drumright floodway (Tiger Creek basin) is littered with much debris from many sources, including plant overgrowth, trash, illegally dumped material, concrete, pipe and other such materials. This project would clean out much of this debris. With a cleaner channel, water would flow more efficiently which means floods would be of a lesser scale and erosion would be reduced.

2. Develop a plan with the Police Department and the Fire Chief to expand enforcement of the floodplain regulations.

Hazard Type: Flood
Project Type: Mitigation
Lead: Drumright Fire Chief
Time Schedule: FY 2013 and ongoing
Estimated Cost: $500 to $1,000 per case
Source of Funding: Local/Grant
Work Product: An organized plan to enforce the floodplain regulations
Expected Outcome: People have stored “junk” within the 100 year flood plain. In the event of a sudden and heavy downpour that continued for some time, the floodplain could be underwater. The presence of junk and debris in the floodplain could cause more serious flooding issues downstream and floating items carried by storm water cause property damage or injury to persons.

3. Replace undersized water lines, add fire hydrants and add at least one water storage tank.

Hazard Type: Wildfires
Project Type: Mitigation
Lead Agency: City of Drumright
Time Schedule: FY 2013-2020
Estimated Cost: $2,000,000
Source of Funding: Local/Grants
Work Product: Upsize most of the City's water distribution lines, add fire hydrants and add at least one water storage tank.
Expected Outcome: The City of Drumright has insufficient water in some parts of town especially on the fringe areas which are most at risk for wildfires. Lines need to be increased in size, fire hydrants added and at least one water storage tank on the SE side needs to be added so that adequate water pressure exists to utilize the fire hydrants and serve the customers' needs. This would have the added benefit of a reduced ISO rating for insurance purposes.

4. Install perimeter fencing around City's water well sites.

Hazard Type: Hazardous Material Event (Water well contamination)
Project Type: Mitigation
Lead: City of Drumright
Time Schedule: FY 2013 – 2015
Estimated Cost: $4,000 per well site. Total $24,000
Source of Funding: Local
Work Product: Install a 50 foot perimeter fence around all off-site well locations.
Expected Outcome: A 50 foot perimeter fence is recommended by the OK. Dept of Environmental Quality to prevent cattle and other animals from being in close proximity to the wellheads.

5. Establish fire breaks in the wild land/urban interface areas.

Hazard Type: Wildfires
Project Type: Mitigation
Lead: Fire Chief
Time Schedule: As funds become available
Estimated Cost: $500,000
Source of Funds: Grant/Volunteer/City
Work Product: A fire resistant buffer between the incorporated areas and the county areas within Drumright's fire protection area.
Expected Outcome: Minimization of the area of the city exposed to the danger of wildfires and easier containment of wildfires.

6. Establish an inventory of emergency generators for loan to the elderly and disabled population of Drumright.

Hazard Type(s): Severe Winter Storms, High Winds, Tornados
Project Type: Mitigation
Lead: Emergency Management Director (Fire Chief)
Time Schedule: As Funding permits
Estimated Cost: $25,000
Source of Funds: Local and Grant
Work Product: Establish an inventory of emergency generators that can be accessed to provide power to the homes of disabled and elderly individuals during extended periods of power outages which typically accompany severe ice storms, wind storms, and tornado activity.
Expected Outcome: Lives could be saved as persons who have critical power needs such as oxygen machines, etc. would have access to power when normal power supplies are cut off due to natural disasters.

7. Hazard Occurrence Database

Hazard Type: All Hazards
Project Type: Mitigation
Lead: City Administration
Time Schedule: On-going once started.
Estimated Cost: $1,000 per year.
Source of Funding: Local
Work Product: An ongoing narrative and historical account of any disaster, activities, shortcomings, and equipment needed or used and sources of resources, etc.
Expected Outcome: Community Specific information would be available about events, things done successfully, what could be improved, where resources came from, etc.

8. Identify hazardous material types and plan for hazardous material events on transportation routes and insure that the Drumright Police and Fire Departments are appropriately trained on hazardous material handling.

Hazard Type: Hazardous Material
Project Type: Mitigation
Lead: Fire Department
Time Schedule: Begin in FY 2013 with ongoing training.
Estimated Cost: $3,500 per year.
Source of Funding: Oklahoma Fire Service Training Academy/Local
Work Product: A plan to address hazardous materials spills and accidents involving hazardous materials carriers.
Expected Outcome: An efficient and adequate response to hazardous materials events for the protection of the public.

9. Develop and prepare a water conservation or drought contingency plan.

Hazard Type: Drought, Hazardous Material Event (Water Source Contamination and Mechanical Failure)
Project Type: Mitigation
Lead Agency: City Administration
Time Schedule: FY 2013
Estimated Cost: $2,000
Source of Funds: Local and Grants
Work Product: A plan to deal with severe water shortages or curtailment of supply of potable water due to severe drought, water source contamination or the physical ability to meet the demand that would be implemented in stages as the problem becomes more severe.
Expected Outcome: A plan to deal with water shortages in an orderly and well-reasoned manner.

10. Develop a routine Storm Siren testing procedure.

Hazard Type: Tornados and High Winds
Project Type: Mitigation
Lead Agency: Fire Department
Time Schedule: FY 2013
Estimated Cost: $500 per year.
Source of Funding: Local
Work Product: A regular routine of testing sirens on a scheduled basis that can be communicated to the public so that they are not alarmed when they year the sirens.
Expected Outcome: An assurance that sirens do work when needed and confidence in early warning system by the citizens.

The Town of Kellyville has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigation activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. The Town of Kellyville selected two activities to make up their Action Plan, as follows.

1. Stationary mounted 35KW emergency generators to qualify Fire Station and Town Hall as emergency shelters.

Hazard Type: Severe Winter Storms
Project Type: Mitigation
Lead Agency: Fire Department and Town Administration
Time Schedule: FY 2013
Estimated Cost: $80,000. (2 at $40,000 each).
Source of Funding: Local Revenue and Grants
Work Product: Purchase and installation of two stationary mounted 35KW emergency generators; one for the fire station and one for the Town Hall.
Expected Outcome: To make the Fire Station building and the Town Hall building as Red Cross compliant emergency shelters

2. Education brochures to document procedures and precautions during extended power outages caused by severe winter storms.

Hazard Type: Severe Winter Storms
Project Type: Education
Lead Agency: Fire Department and Town Administration
Time Schedule: FY 2013
Estimated Cost: $2,500.
Source of Funding: Local Revenue
Work Product: Educational brochures
Expected Outcome: Educate the public on how to be prepared for extended power outages during cold weather.

The Allen Bowden Public Schools has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. The District selected four mitigation activities to make up their Action Plan, as follows.

1. Provide safe room for school and community. The Gym and Safe Room would provide ample space for community to seek shelter from tornados.

Hazard Type: Tornado
Project Type: Mitigation
Lead Agency: Allen Bowden Schools
Estimated Cost: $ 2,500,000
Source of Funding: Grants and Local Funds
Work Product: Gym/Safe Room for the school and community, due to the high number of trailer houses and low income dwellings in the district and for the safety of the students attending school the safe room would need to be capable of housing 1000 or more individuals during a tornado outbreak.
Expected Outcome: The Allen Bowden School is listed as an emergency shelter. This would add an additional layer of support and protection during time of an emergency in our district.

2. Provide surge protection and uninterrupted power source for the campus in the event of a catastrophic electrical failure.

Hazard Type: Lightning/Ice Storm
Project Type: Mitigation
Lead: Allen Bowden Schools
Time Schedule: FY2013-2014
Estimated Cost: $25,000 per unit with 3 units needed to cover campus.
Source of Funding: Grants and Local Funds
Work Product: Generator to provide uninterrupted power during a power failure.
Expected Outcomes: This would provide a safe environment in the event the facility is needed for an emergency shelter.

3. Snow Removal Equipment

Hazard Type-: Winter Storm
Project Type-: Mitigation
Lead: Allen Bowden Schools
Time Schedule: FY2013-2014
Estimated Cost: $50,000
Source of Funding: Grants and Local Funds
Work Product: Acquisition of tractor with frontend loader for snow removal and sand spreading.
Expected Outcome: Equipment will be used to clear snow in areas around the school to provide access in the case facility is needed for shelter.

4. Weather Bug Weather station, to provide accurate and up to date weather information to all members of the school and community emergency management team.

Hazard Type: Floods, Tornado. High Winds, Winter Storms
Project Type: Mitigation
Lead: Allen Bowden Schools
Time Schedule: FY2013-2014
Estimated Cost: $15,000
Source of Funding: Grants and Local Funds
Work Product: Channel 2 weather department would provide setup and software for a weather station to be placed on our site.
Expected Outcome: Accurate and up to date on site weather information, available with the click of a mouse. This would help keep the community and school safe in all emergency related situations.

The Bristow Independent School District has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE +E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. Once funding is sought, a detailed benefit/cost analysis will be done and will follow the requirements of the funding source. The District selected four mitigation activities to make up their Action Plan. The mitigation activities are:

1. School Safe Room at Kindergarten Building

Hazard Type: Tornado, High Winds
Project Type: Mitigation
Lead: Bristow Public Schools
Time Schedule: FY2013-14
Estimated Cost: $75,000.00
Source of Funding: Local / Grants
Work Product: The work product will be the construction of a safe room in the new Kindergarten building.
Expected Outcome: A safe secure location for our students and staff during storms.

2. Install Lightening Rods and Surge Protectors at all School Buildings

Hazard Type: Lightening
Action Plan: Mitigation
Lead: Bristow Public Schools
Time Schedule: As funds become available
Estimated Cost: $100,000.00
Source of Funding: Grants
Work Product: To install lightening rods and surge protection devices at all school buildings.
Expected Outcome: The expected outcome is to protect students, buildings and electrical equipment from lightening strikes.

3. Upgrade Intercom Systems at the District's four school sites.

Hazard Type: Tornado and Hazardous Material Events
Action Plan: Mitigation
Lead: Bristow Public Schools
Time Schedule: As funds become available
Estimated Cost: $80,000
Source of funding: Grants
Work Product: The work product would be to upgrade all intercom systems in our school district.
Expected Outcome: The expected outcome would be to better inform the students and staff in the event of hazardous / dangerous events.

4. Communication Equipment

Hazard type: Hazard with short notification time. Floods, Tornados, High Winds, Lightning, Hail, Severe Winter Storms, Wildfires, Earthquakes, Hazardous Materials Events. (And General Emergencies).
Project Type: Mitigation
Lead : Bristow Public Schools
Time Schedule: As funds become available
Estimated Cost: $20,000.00
Source of Funding: Grants
Work Product: To provide hand held radios to all sites in the school district
Expected Outcome: With the purchase of these new radios, we will be able to communicate with local agencies as well as all of our school sites in case of emergency situations.

The Drumright Public Schools has reviewed and analyzed the risk assessment studies for the natural hazards and hazardous material events that may impact their jurisdiction. They reviewed the mitigations activities listed in Chapter 4, incorporated the criteria and principles of the STAPLE+E project evaluation method in their consideration of the mitigation activities, and prioritized the activities as the County did as was detailed in Section 4.3. The District selected five mitigation activities to make up their Action Plan, as follows.

1. Install a 2-way radio system for the buses and other district base sites.

Hazard Type: Tornado/Hazardous Events/Winter Storms
Project Type: Mitigation
Lead: Drumright School District Administration
Time Schedule: As funds are made available
Estimated Cost: $40,000
Source of funding: Grant, bond issue and/or local funds
Work Product: The work product would be to install two-way radios in all busses, four mobile units for administration and a base unit for the district office.
Expected Outcome: The expected outcome would be to have a means of communication with all busses, district vehicles, and administrators in the event of hazardous events.

2. Install water drainage system to remove run-off water from areas that penetrate buildings.

Hazard Type: Flooding of buildings during rainstorms and winter snow and ice melt.
Project Type: Mitigation
Lead: Drumright School Administration and Maintenance staff
Time Schedule: As funds become available
Estimated Cost: $50,000
Source of Funding Grant, Bond Issue, or local funds
Work Product/Expected Outcome: Install berms, french drains, downspouts, and pumps, or other devices to prevent water from entering lower levels of buildings. Outcome is to prevent mud, water damage and mold.

3. Replace or upgrade the intercom system at Bradley Elementary School including the addition of an outdoor warning system.

Hazard Type: Tornado, Hazard Materials Events, Lightning
Project Type: Mitigation
Lead: Drumright School District Administration
Time Schedule: As funds are available
Estimated Cost: $25,000
Source of funding: Grants/Local
Work Product: The work product would be to upgrade the intercom system inside and add outside speakers and other warning components. The outcome would be to better inform the students and staff on the playgrounds, bus loading areas, and other areas of the campus when hazardous events are eminent.

4. Safe Rooms in Elementary School.

Hazard Type: Tornado, High Wind
Project Type: Mitigation
Lead Agency: Drumright School District Administration
Time Schedule: As funds become available.
Estimated Cost: To be determined based upon the specific facility requirements
Source of funding: Grants, bond issue, local funds
Work Product: A large capacity safe room at Bradley Elementary school for students, staff and community.
Expected Outcome: Protection of students, staff, and community during severe weather conditions

5. Install an electric power back-up system at each site.

Hazard Type: Severe winter storm or tornado
Project Type: Mitigation
Lead: Drumright School District Administration
Time Schedule: As funds become available
Estimated Cost: $25,000 - $75,000
Source of Funding: Grants, Bond Issue, local funds
Work Product: The work product would include the purchase and installation of gas or natural gas generators at the elementary school, middle school, high school and the maintenance/bus facility.
Expected Outcome: The outcome would be the ability to power the buildings including the gym with electricity, heat, and/or AC to protect equipment and house displaced community members until power is restored to homes.

Chapter 6:

Plan Maintenance and Adoption

This chapter includes a discussion of the plan maintenance process and documentation of the adoption of the plan by the Creek County Emergency Management Advisory Committee and the Creek County Board of County Commissioners.

6.1 Monitoring, Evaluating, Updating the Plan

The Chairman of the Board of County Commissioners and the Emergency Management Director will oversee the day-to-day implementation of the plan. Monitoring will include getting quarterly reports from the agencies and departments involved in the mitigation activities as to their progress in implementing the projects included the Action Plan that fall within that agency's or department's scope of responsibility.

The Creek County Emergency Management Advisory Committee will also evaluate the mitigation plan on an annual basis. The evaluation shall include reviewing the goals and objectives of the mitigation plan for any changes. The evaluation will also include a review of the hazards in the plan to determine if the risks or hazard locations have changed. The Creek County Emergency Management Advisory Committee will complete and provide an annual evaluation to the Board of County Commissioners summarizing the accomplishments of the mitigation activities. In the action plan, the Creek County Emergency Management Advisory Committee will review the items identified to implement each action plan activity for their appropriateness, and report problems to the Board of County Commissioners. These implementation items include the responsible agency to oversee the mitigation activity, the time schedule, and the funding source.

The Creek County Emergency Management Advisory Committee will make a comprehensive update to the Multi-Hazard Mitigation Plan within five years, from the approval date, as per FEMA requirements, and will be re-submitted to ODEM and FEMA for approval as required.

6.2 Incorporating the Multi-Hazard Mitigation Plan

The Creek County Multi-Hazard Mitigation Plan has been adopted by the Creek County Commission as a guide to county-wide mitigation activities. Appropriate Action Plan activities will be incorporated into the planning process, and in the annual county budget. As stated in section 6.1, the Chairman and the Emergency Management Director will oversee the day-to-day implementation of the plan.

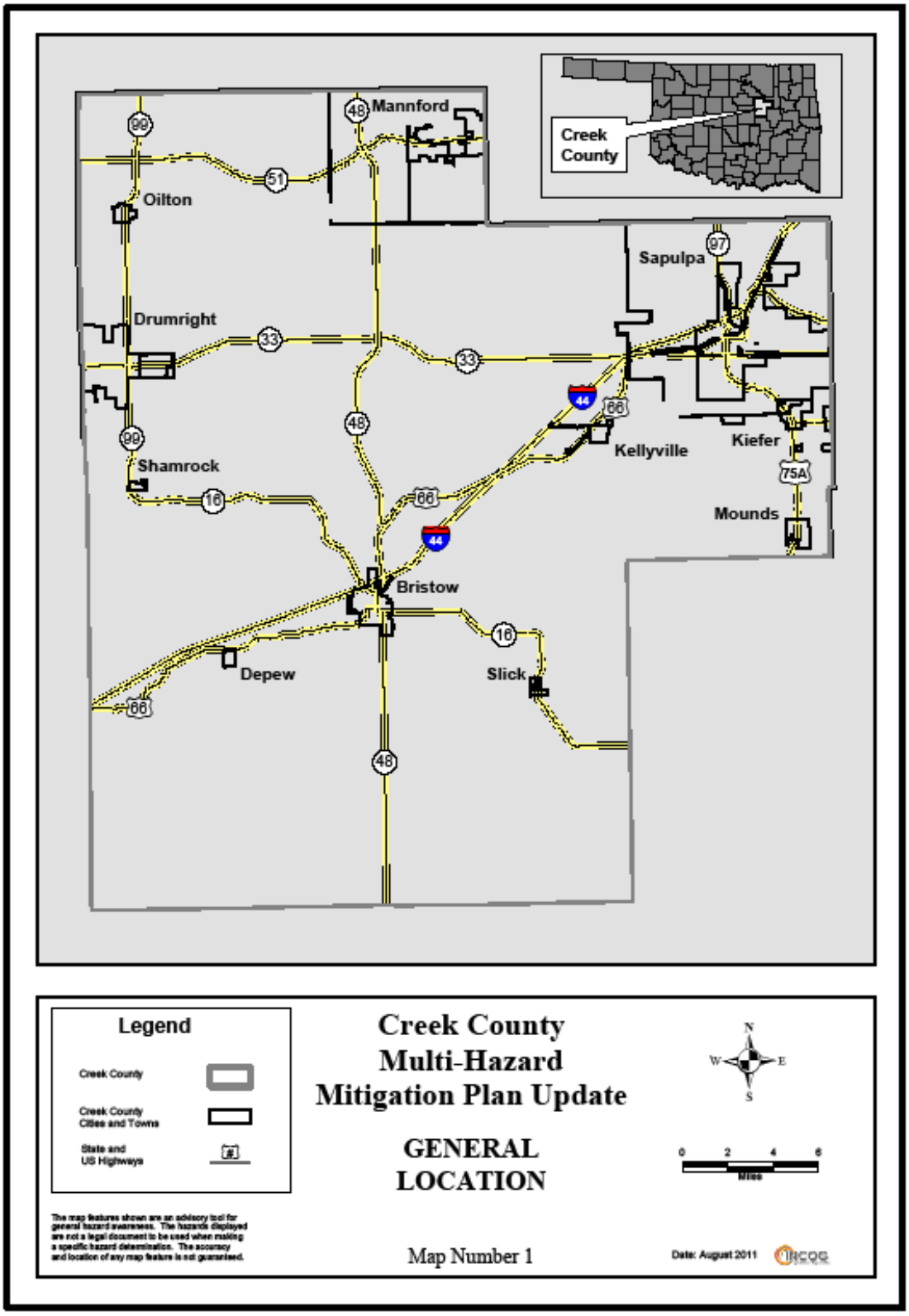
They will work with the CCEMAC to monitor how mitigation activities are incorporated into other county plans. Members of the CCEMAC are also Department Heads charged with the responsibility of updating and enforcing key plans and policies of the County. Creek County currently has a capital improvement plan to guide development and future improvements. These

plans have mitigation strategy components in them, and the County will incorporate any approved the mitigation plan strategies into those plans `when the particular plan is updated. All plans are updated as needed by the County. The inspections department enforces the building codes in Creek County. After adoption of the mitigation plan, the inspections department will continue to enforce the building codes on new construction. Selection of future CIP projects will include consideration of the goals and objectives of the mitigation plan.

6.3 Public Involvement

Creek County is committed to involving the public directly in updating and maintaining the Multi-Hazard Mitigation Plan. Copies of the Plan will be available at the Creek County Emergency Management Office and at the County Courthouse. Input from citizens will be solicited as to how the mitigation process can be more effective. Comments can be made directly to the Chairman of the Board of County Commissioners and the Emergency Management Director.

Appendix 1: Mapping


Creek County
Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Bristow
Depew
Slick
Legend
Creek County
Creek County Cities and Towns
State and US Highways
Creek County Multi-Hazard Mitigation Plan Update
GENERAL LOCATION
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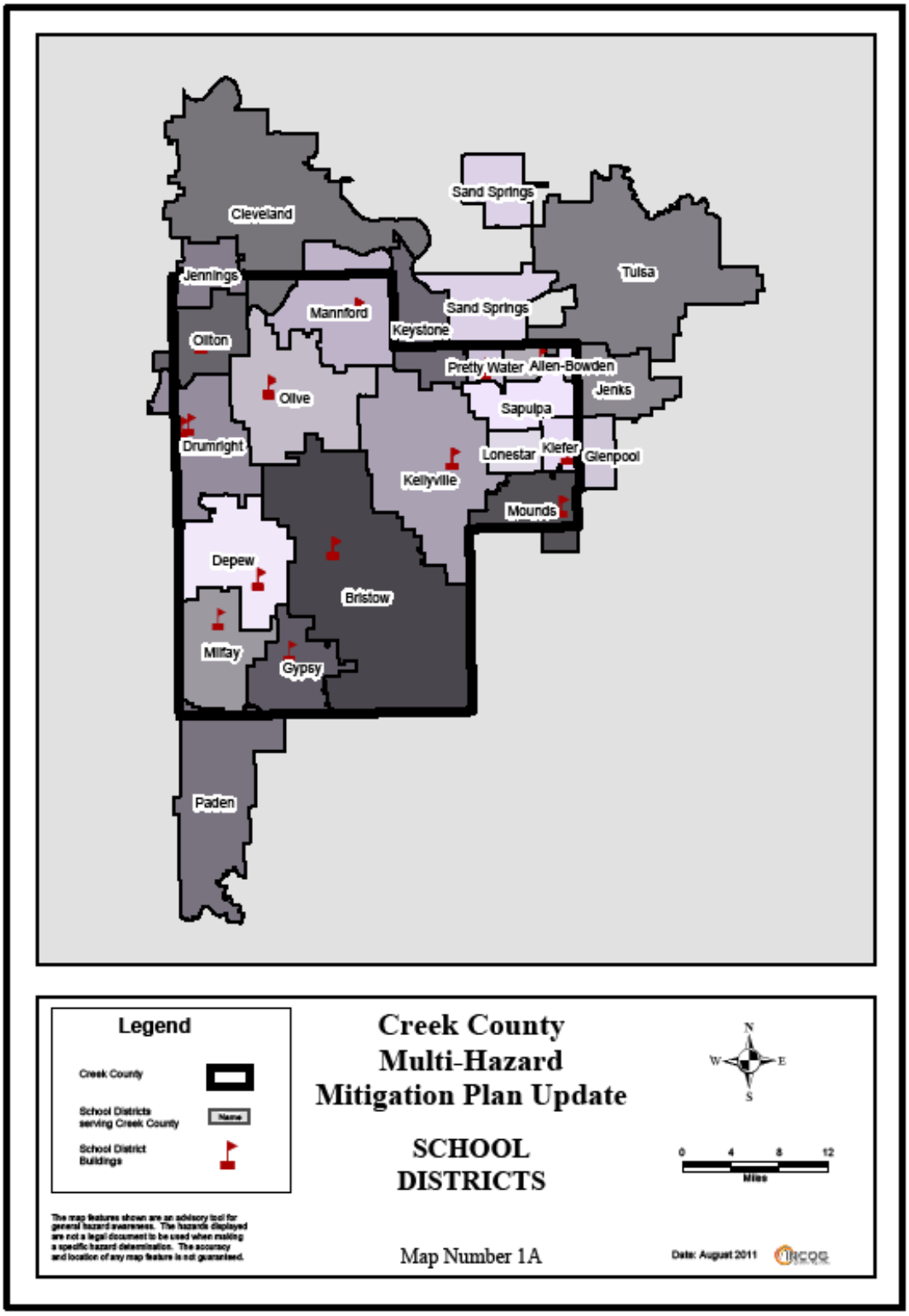
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Map Number 1
Date: August 2011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Jennings
Tulsa
Mannford
Sand Springs
Keystone
Oilton
Pretty Water
Allen-Bowden
Jenks
Olive
Sapulpa
Drumright
Lonestar
Kiefer
Glenpool
Kellyville
Mounds
Depew
Bristow
Milfay
Gypsy
Paden
Legend
Creek County
School Districts serving Creek County
School District Buildings
Creek County Multi-Hazard Mitigation Plan Update
SCHOOL DISTRICTS
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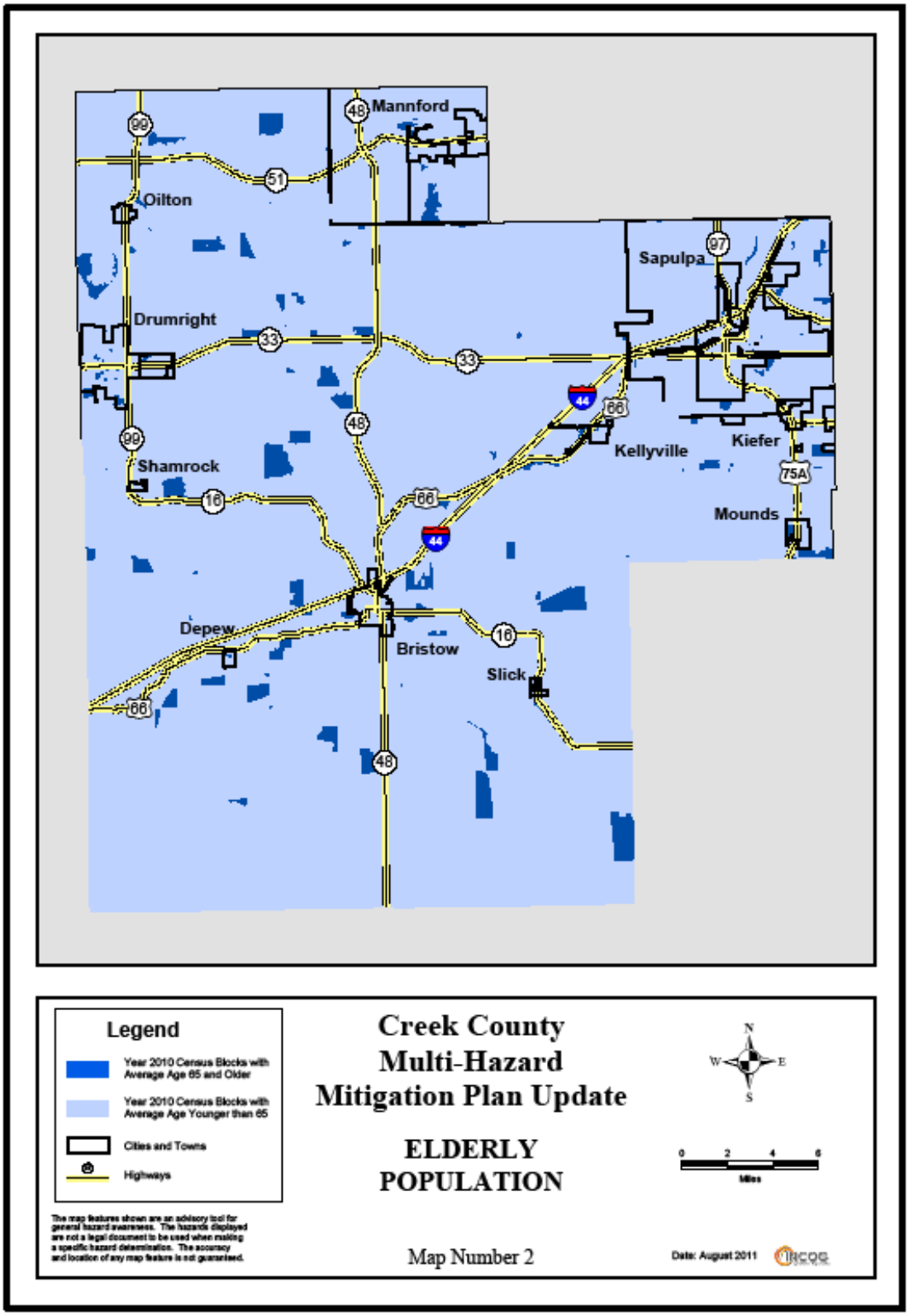
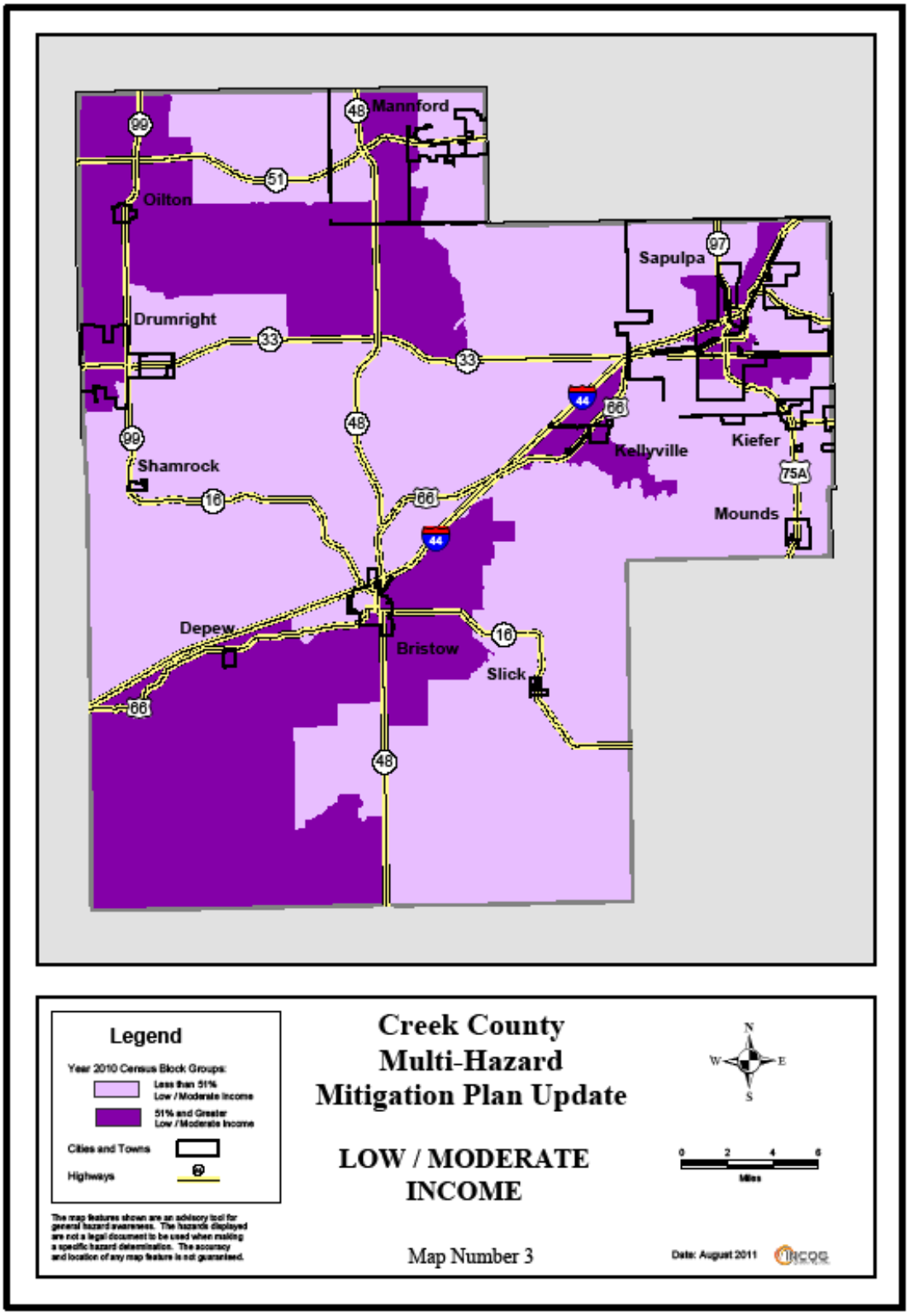
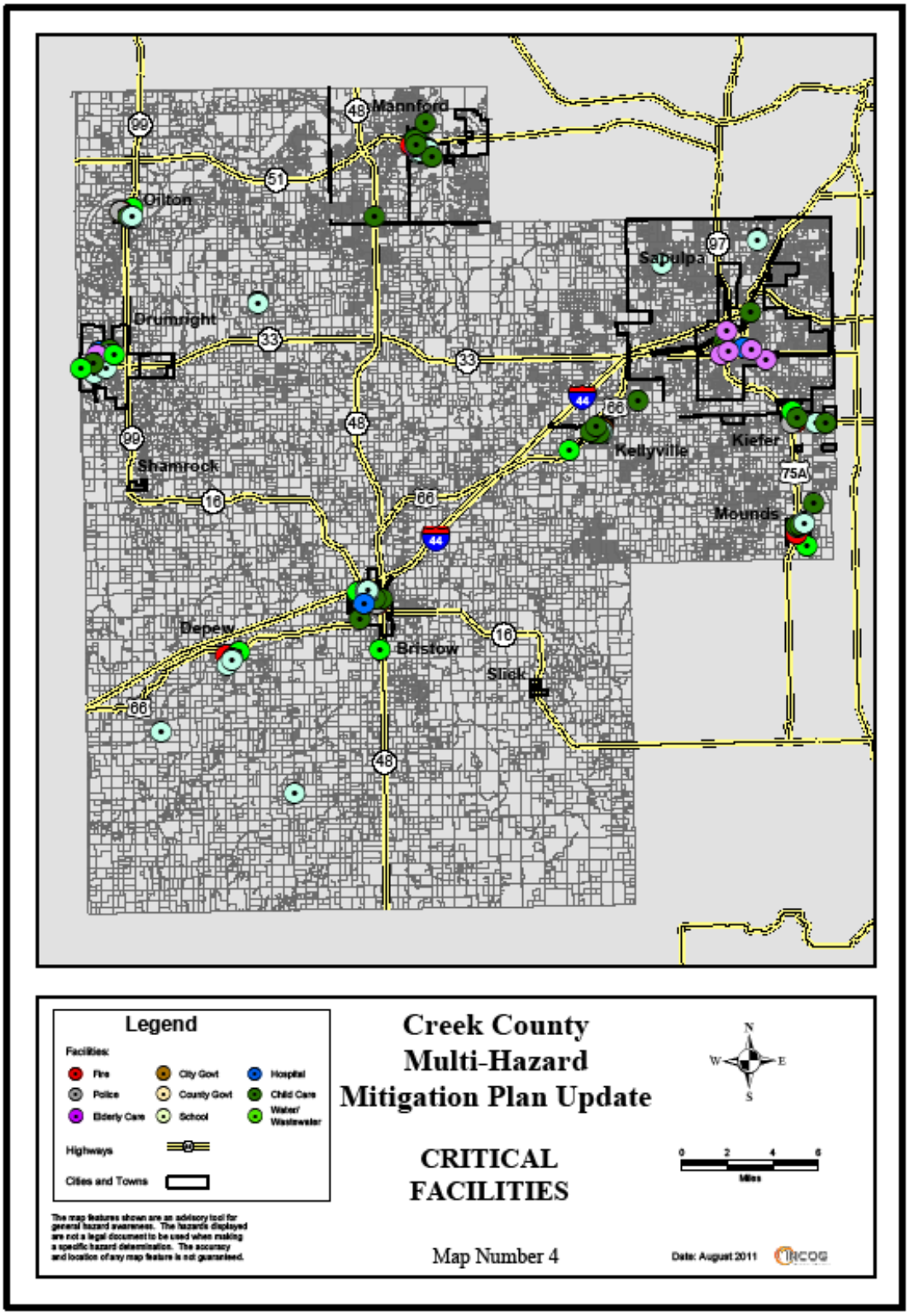
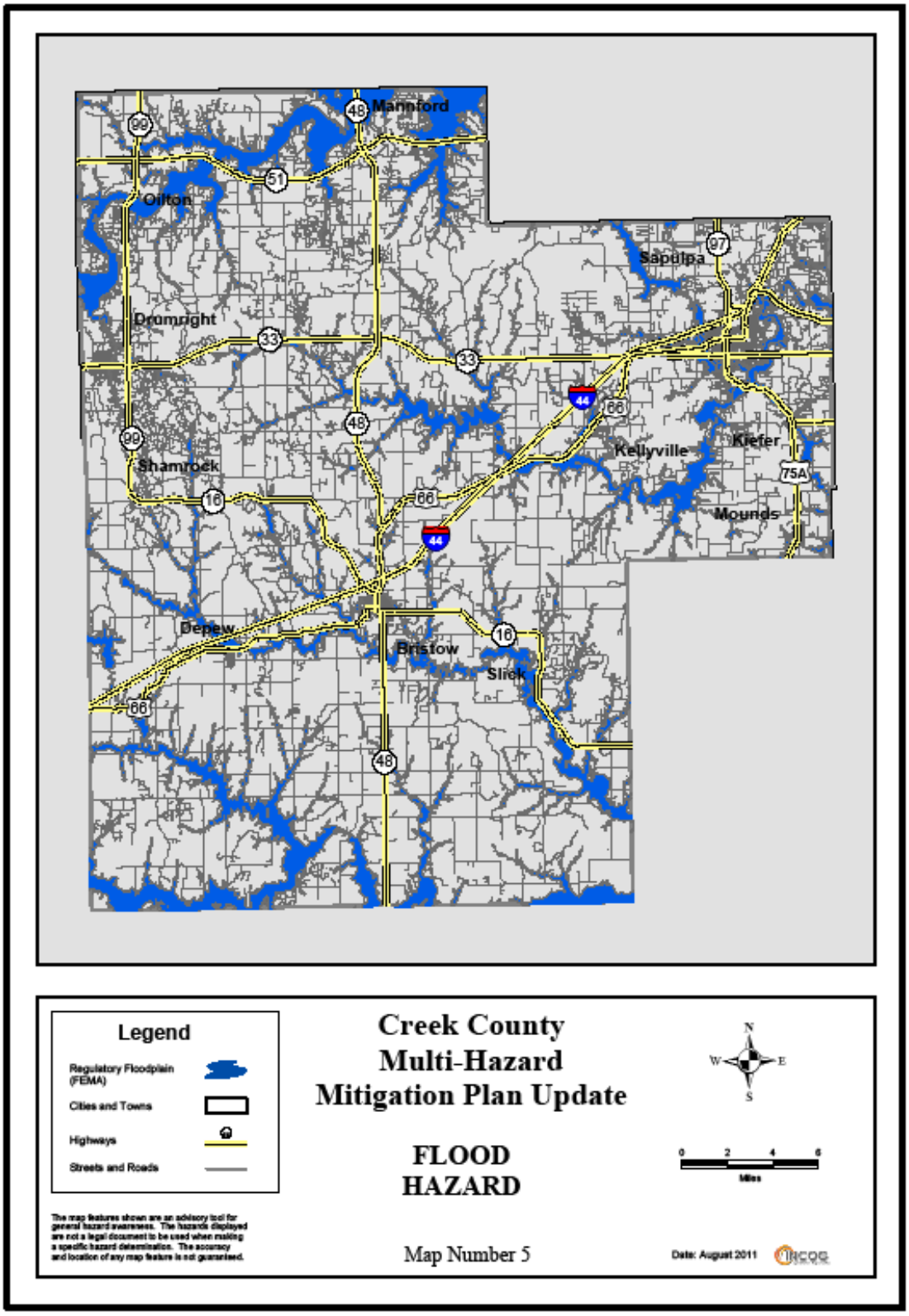
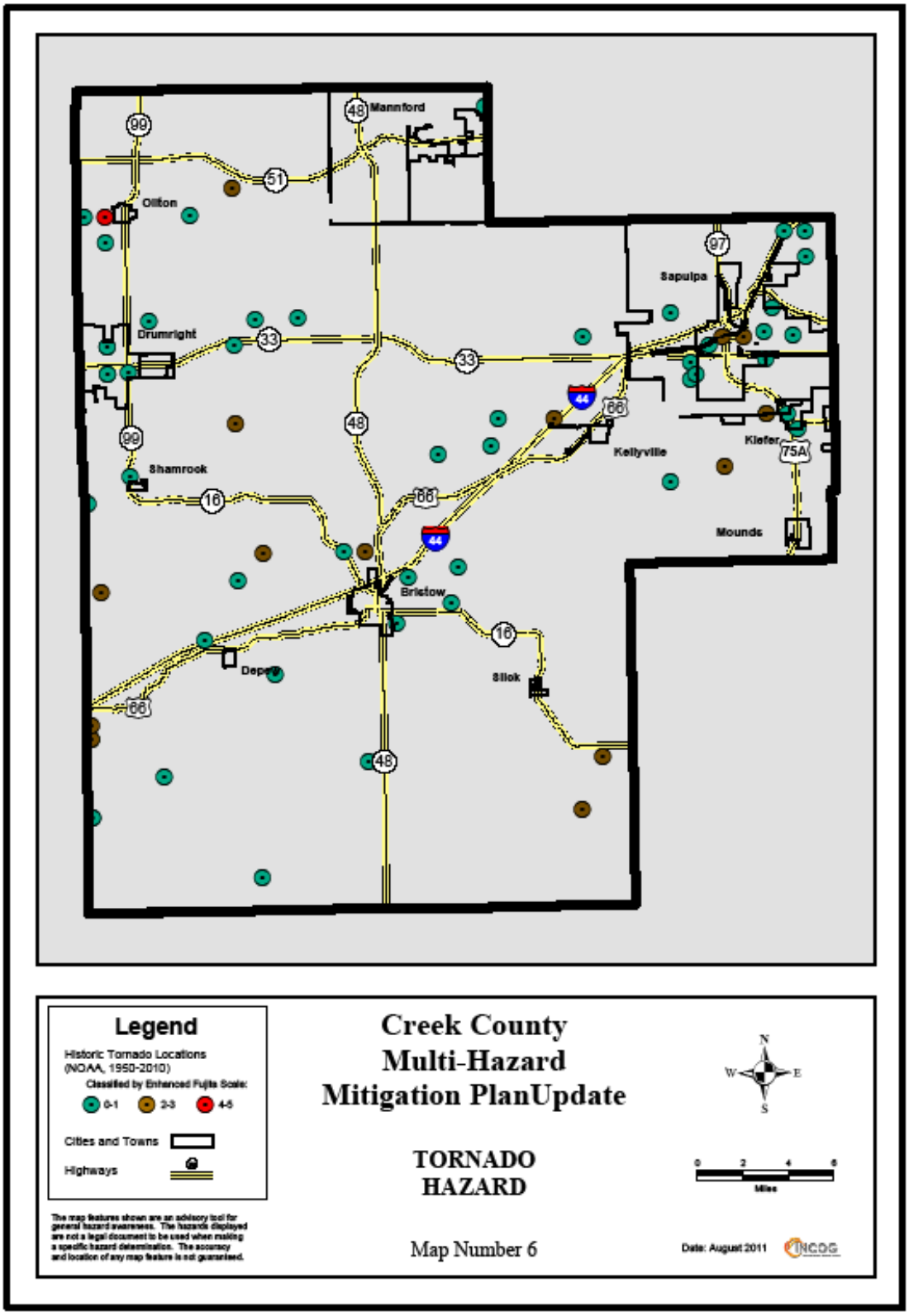
0 4 8 12
Miles
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Map Number 1A
Date: August 2011

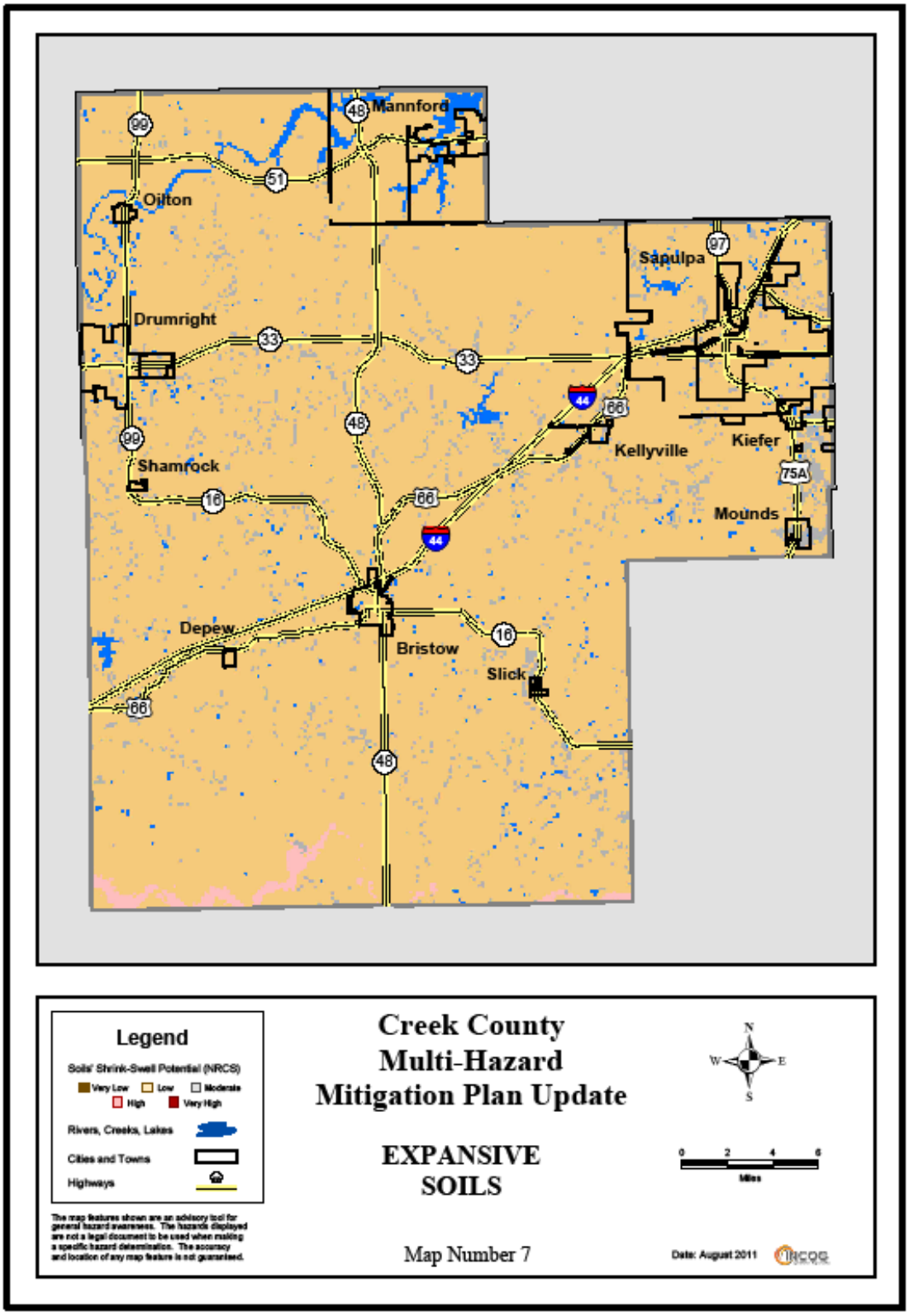

Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
Legend
Year 2010 Census Blocks with Average Age 65 and Older
Year 2010 Census Blocks with Average Age Younger than 65
Cities and Towns
Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
ELDERLY
POPULATION
Map Number 2
Date: August 2011

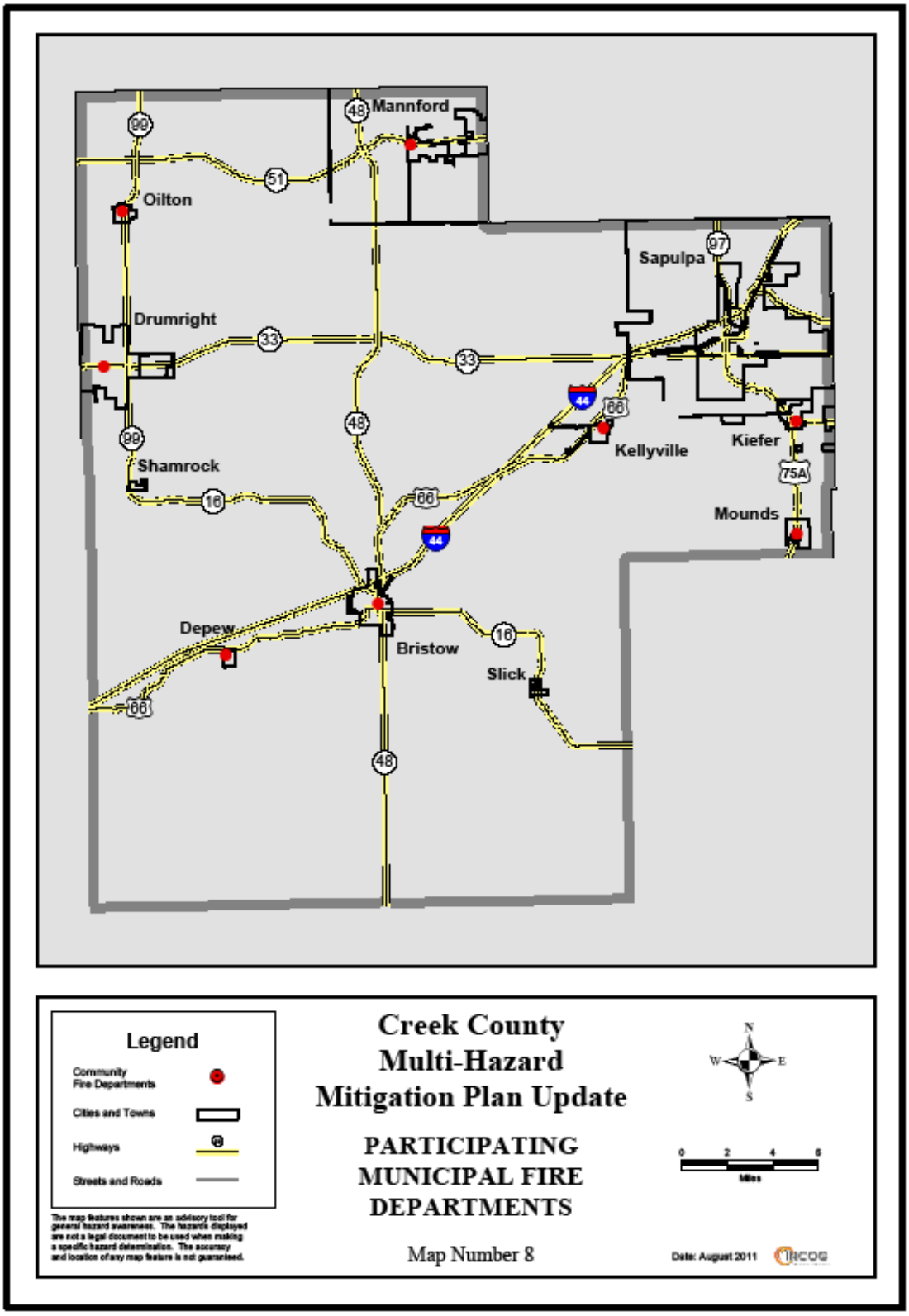

Mannford
Oilton
Drumright
Shamrock
Sapulpa
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
97
33
44
66
16
75A
Legend
Year 2010 Census Block Groups:
Less than 51% Low / Moderate Income
51% and Greater Low / Moderate Income
Cities and Towns
Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
LOW / MODERATE
INCOME
Map Number 3
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG

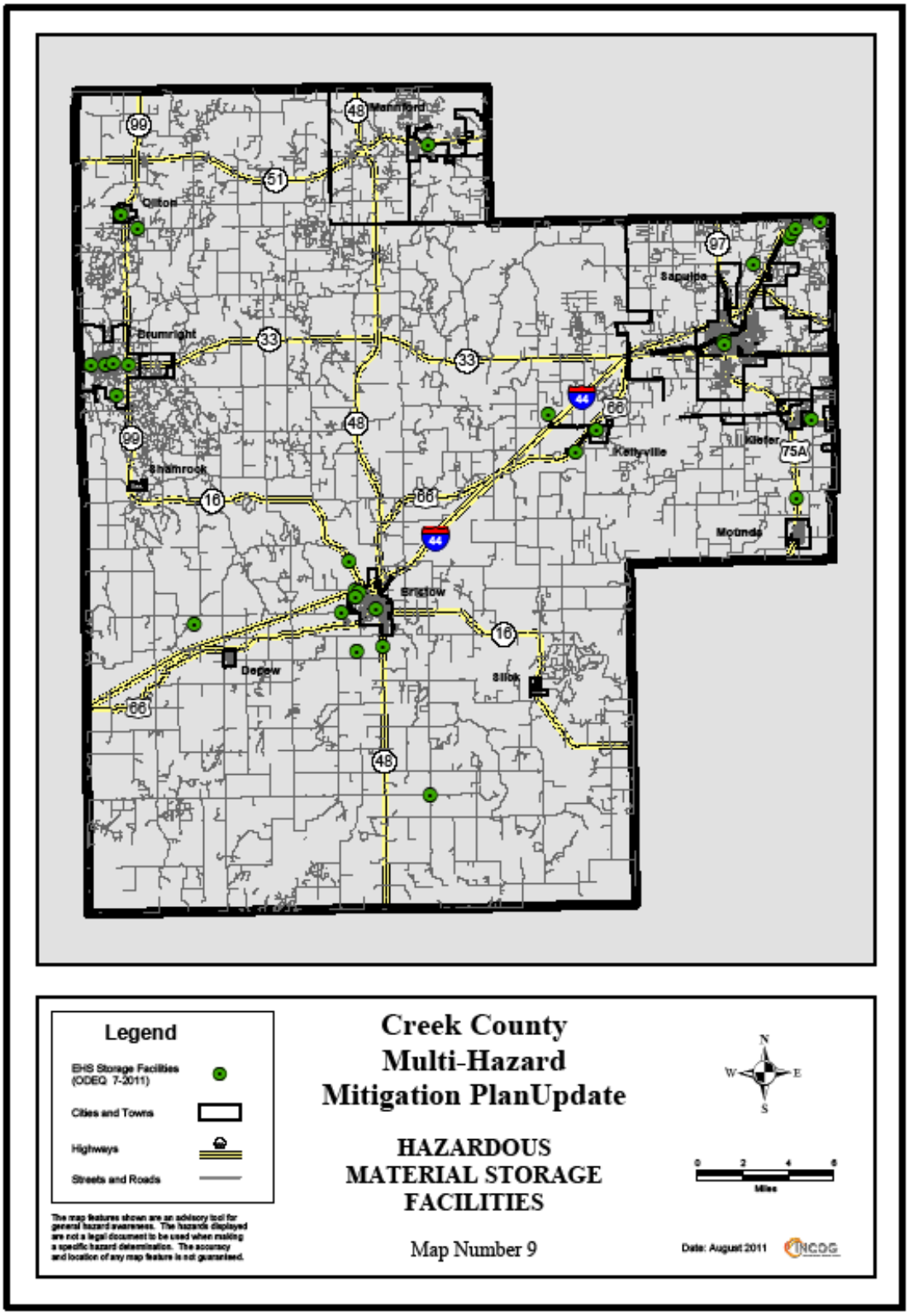

Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
Legend
Facilities:
Fire
Police
Elderly Care
City Govt
County Govt
School
Hospital
Child Care
Water/ Wastewater
Highways
Cities and Towns
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
CRITICAL
FACILITIES
Map Number 4
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG

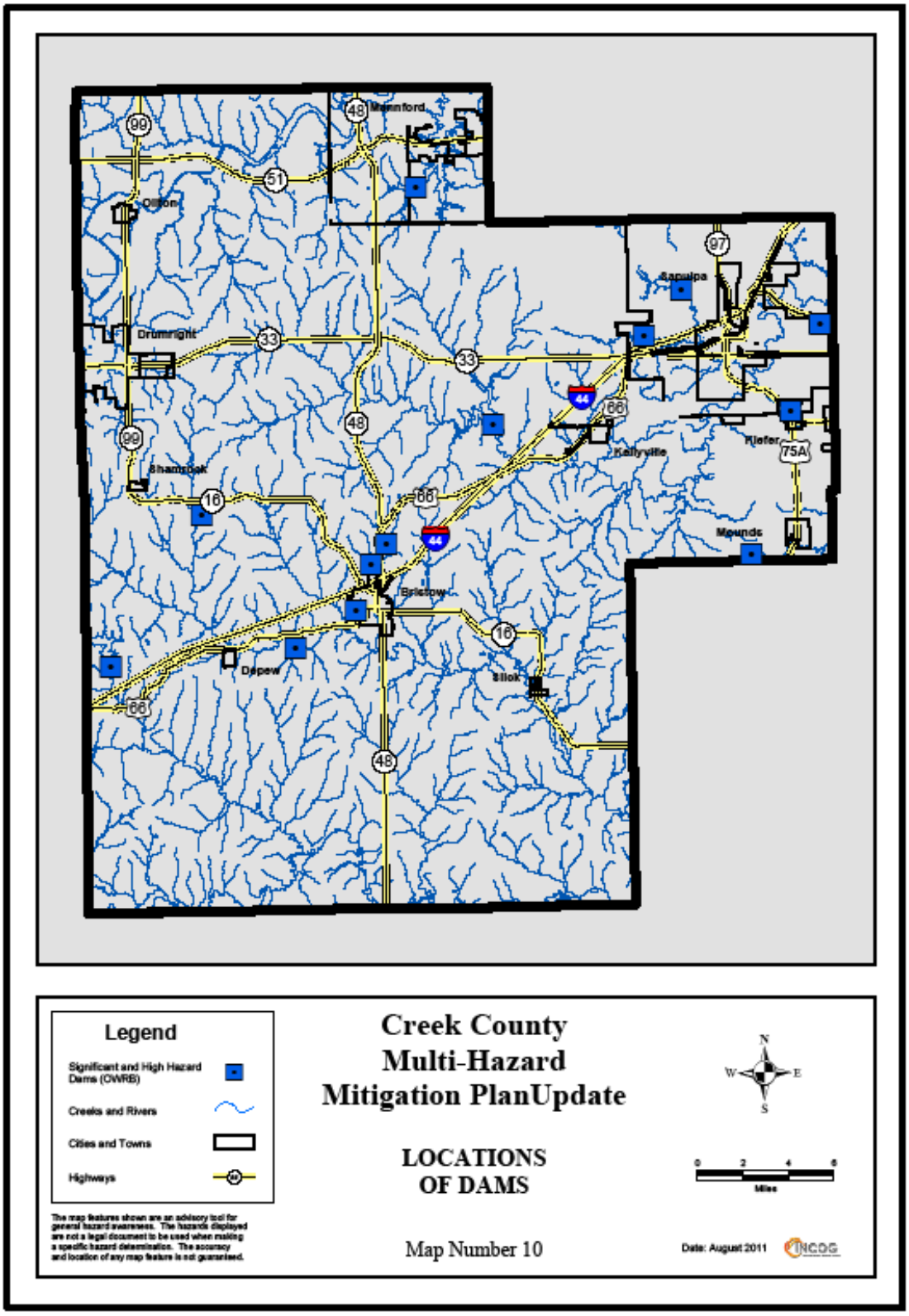

Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
97
33
44
66
16
75A
Legend
Regulatory Floodplain (FEMA)
Cities and Towns
Highways
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
FLOOD
HAZARD
Map Number 5
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG

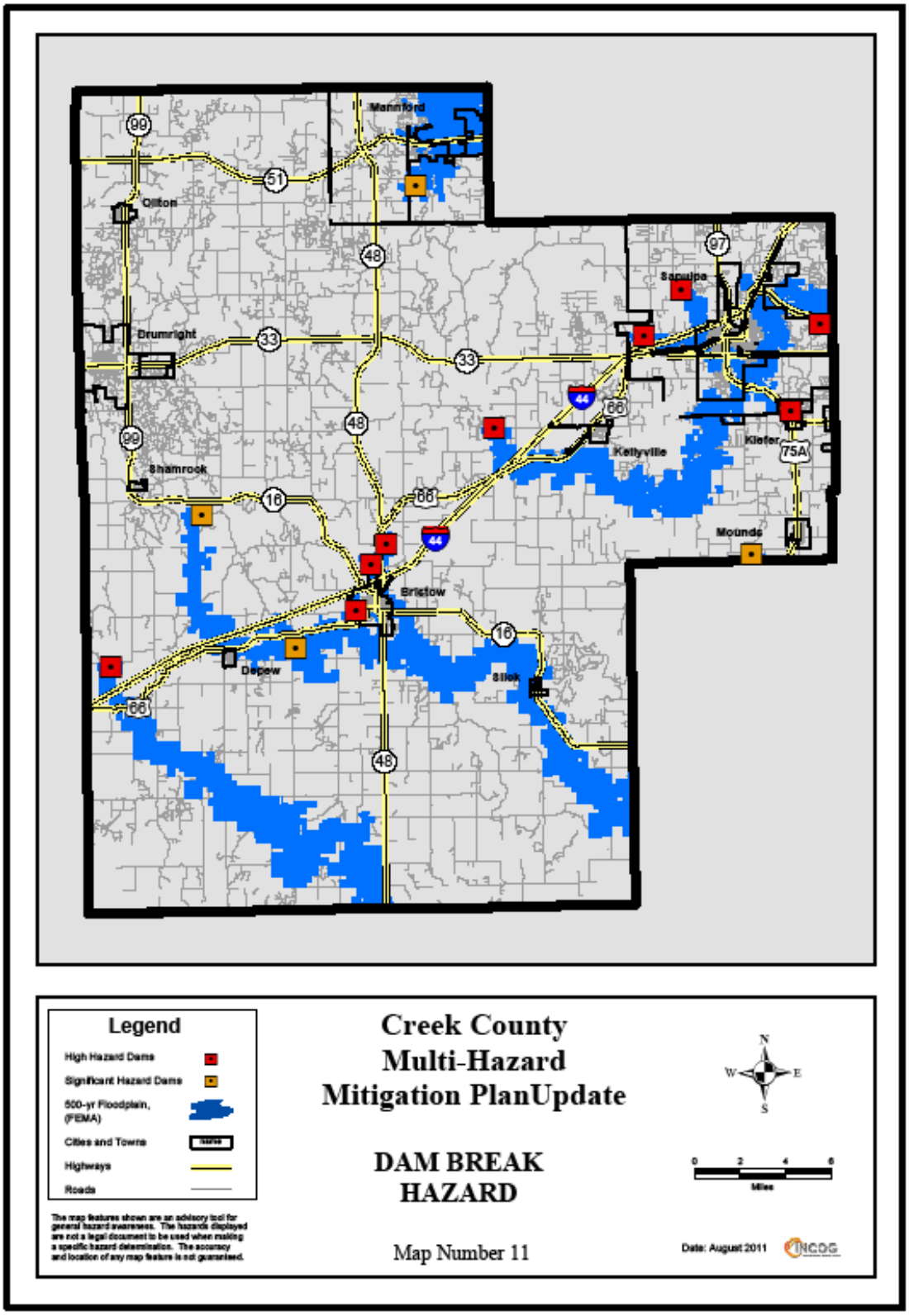

Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Bristow
Depew
Slick
99
51
48
97
33
44
66
16
75A
Legend
Historic Tornado Locations
(NOAA, 1950-2010)
Classified by Enhanced Fujita Scale:
0-1
2-3
4-5
Cities and Towns
Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation PlanUpdate
TORNADO
HAZARD
Map Number 6
N
W
E
S
0
2
4
8
Miles
Date: August 2011
INCOG

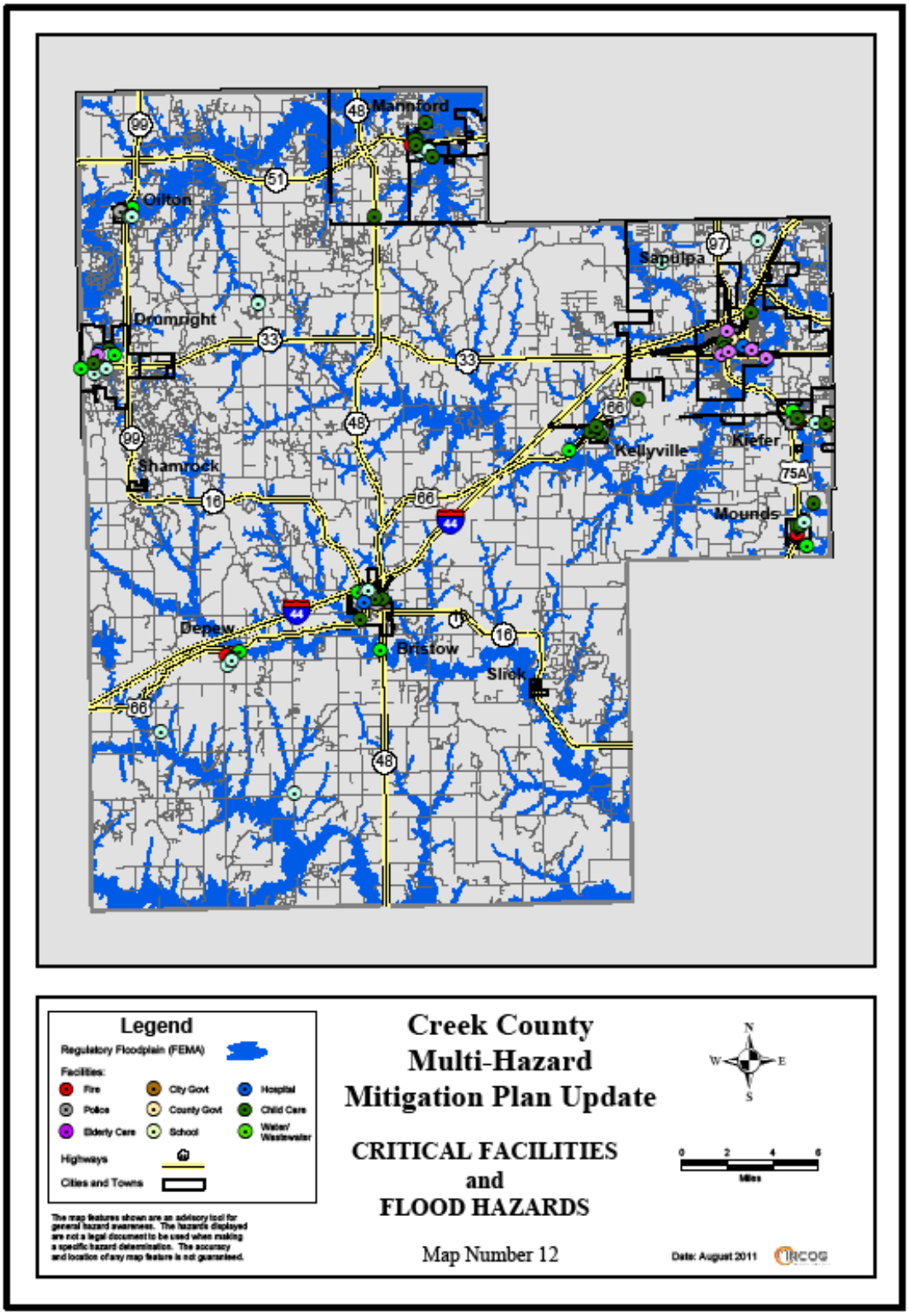

Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
97
33
44
66
16
75A
Legend
Soils' Shrink-Swell Potential (NRCS)
Very Low
Low
Moderate
High
Very High
Rivers, Creeks, Lakes
Cities and Towns
Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
EXPANSIVE
SOILS
N
W
E
S
0
2
4
6
Miles
Map Number 7
Date: August 2011
INCOG

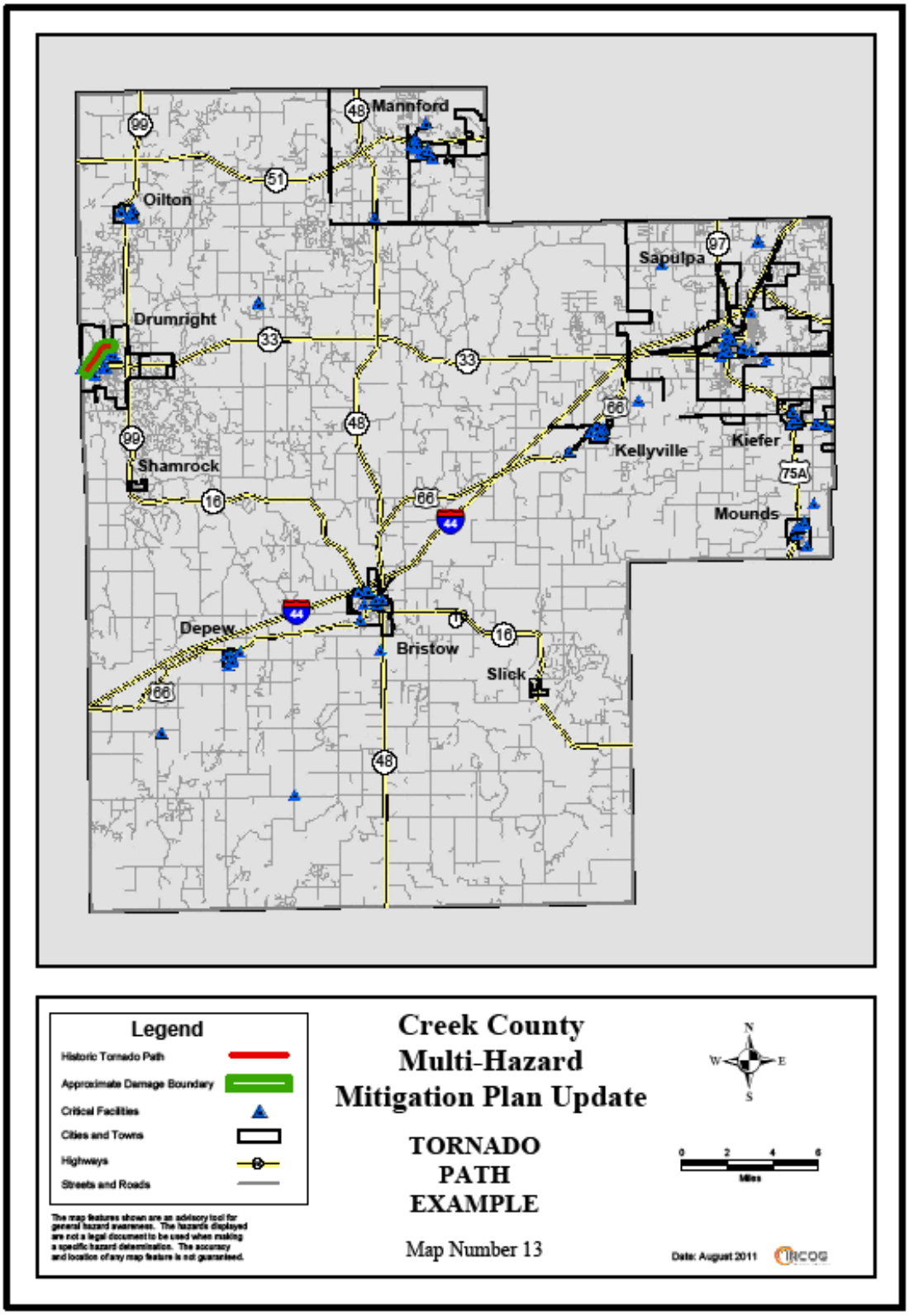

Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
97
33
44
66
16
75A
Legend
Community Fire Departments
Cities and Towns
Highways
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
PARTICIPATING
MUNICIPAL FIRE
DEPARTMENTS
Map Number 8
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG

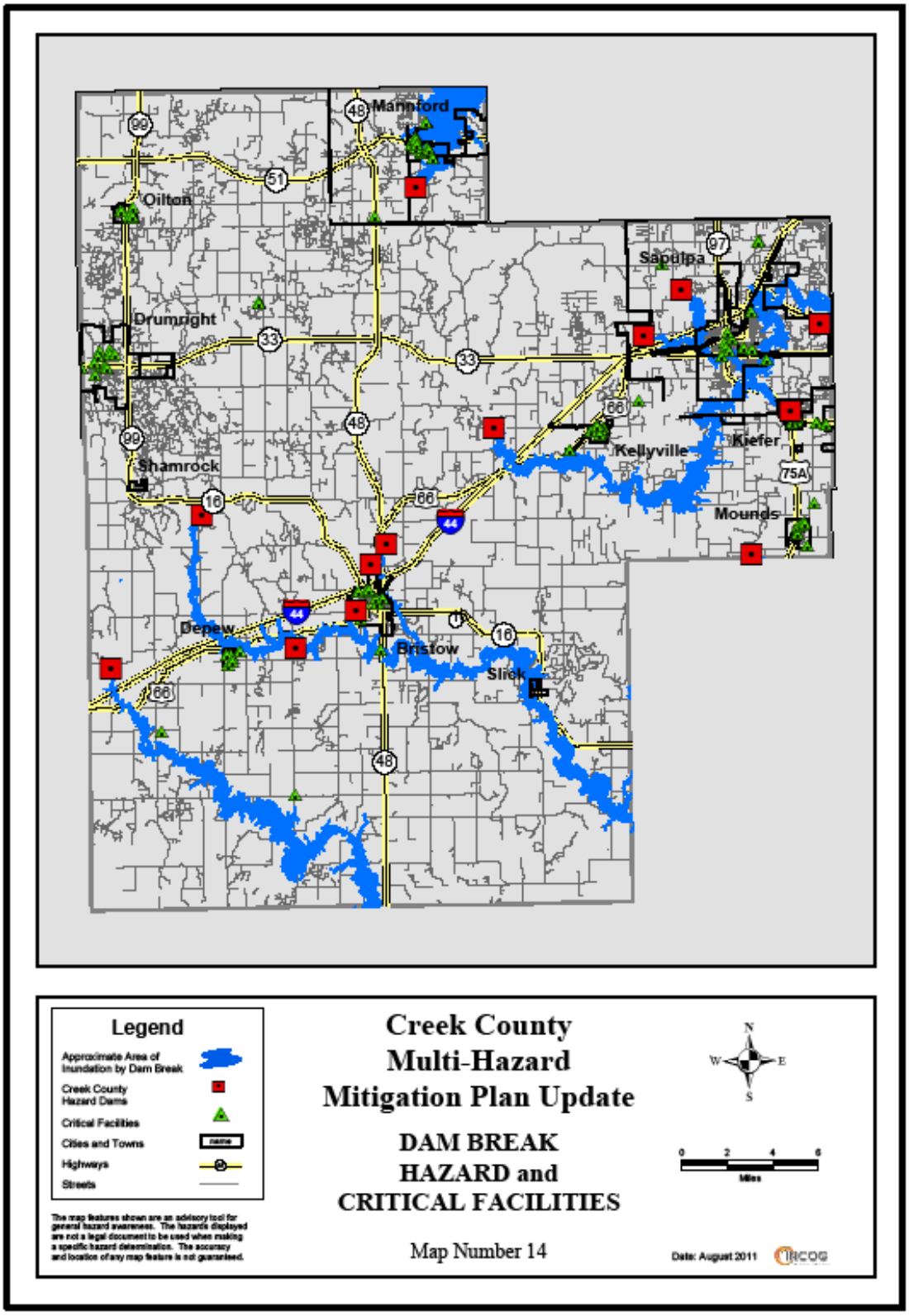

Mannford
Oilton
Drumright
Sapulpa
Kellyville
Kiefer
Shamrock
Mounds
Bristow
Depew
Slick
99
48
51
33
97
44
66
75A
16
Legend
EHS Storage Facilities (ODEQ 7-2011)
Cities and Towns
Highways
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation PlanUpdate
HAZARDOUS
MATERIAL STORAGE
FACILITIES
Map Number 9
N
W
E
S
0 2 4 8
Miles
Date: August 2011
INCOG

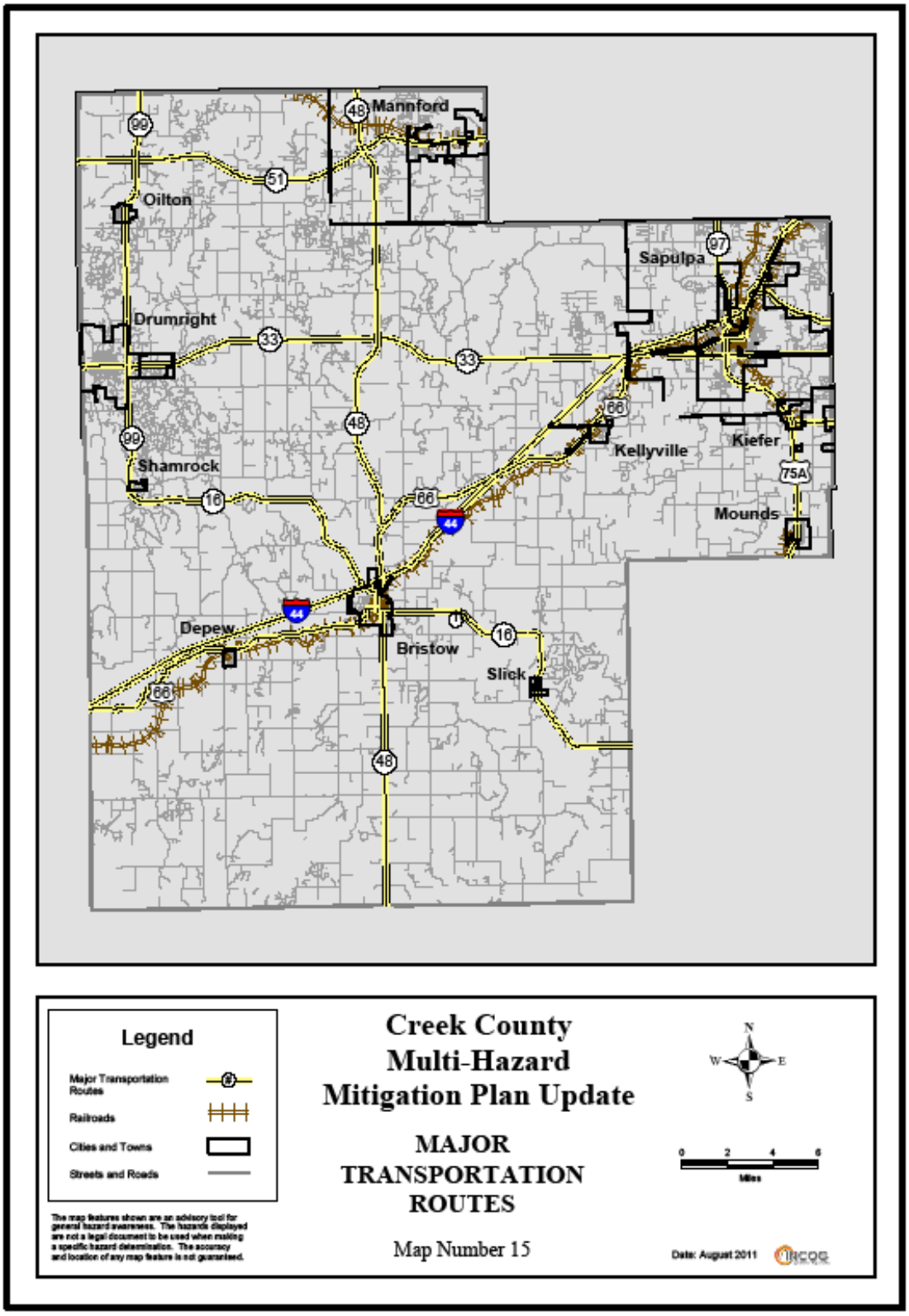

Legend
Significant and High Hazard Dams (OWRB)
Creeks and Rivers
Cities and Towns
Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation PlanUpdate
LOCATIONS
OF DAMS
Map Number 10
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG
Mannford
Oilton
Drumright
Sapulpa
Kellyville
Bristow
Depew
Slick
Shamrock
Mounds
Kiefer
48
51
99
33
97
44
66
16
75A

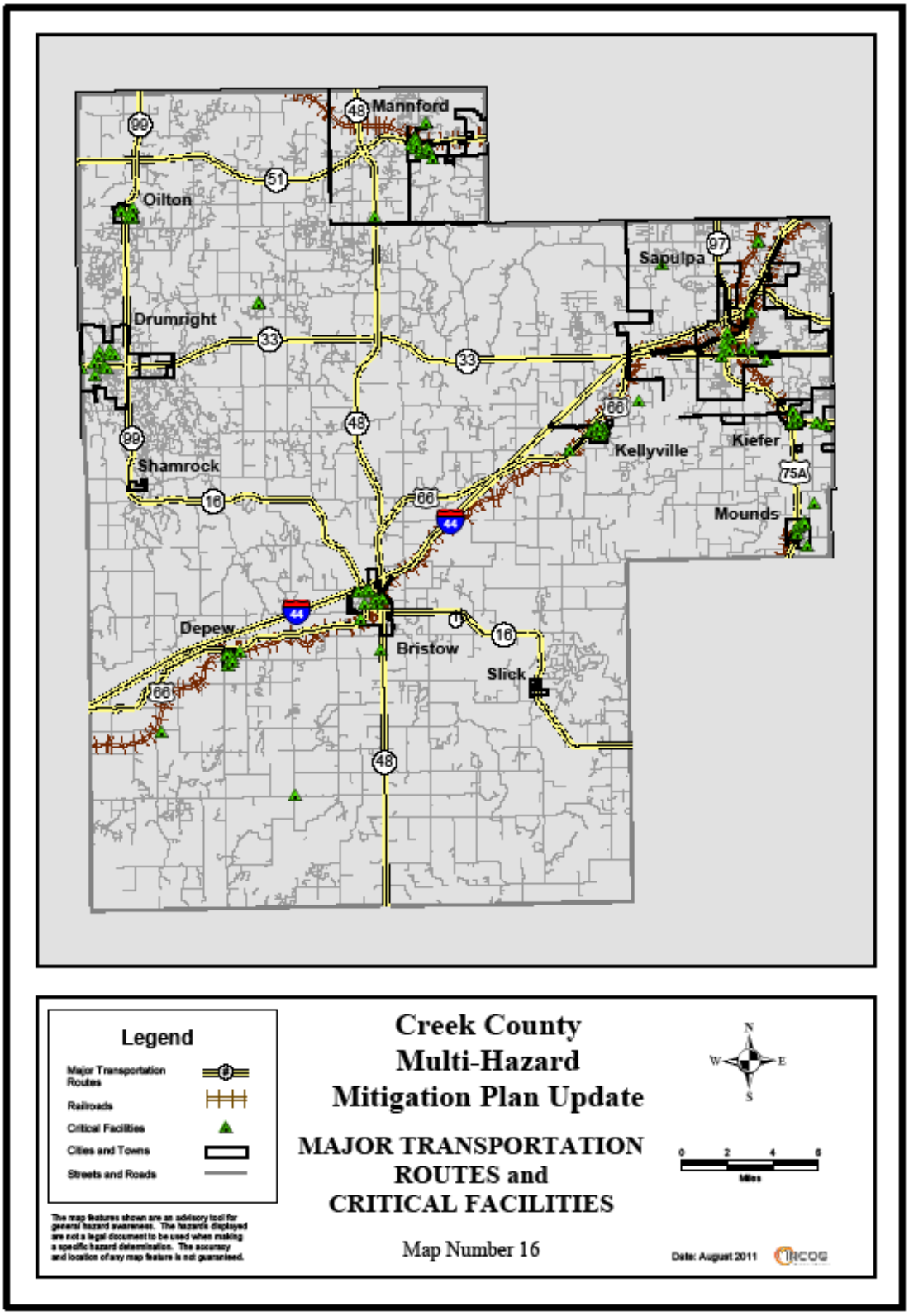

Mannford
Oilton
Drumright
Sapulpa
Kellyville
Kiefer
Shamrock
Mounds
Bristow
Depew
Slick
99
51
48
97
33
44
66
75A
16
Legend
High Hazard Dams
Significant Hazard Dams
500-yr Floodplain, (FEMA)
Cities and Towns
Highways
Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation PlanUpdate
DAM BREAK
HAZARD
Map Number 11
N
W
E
S
0 2 4 8
Miles
Date: August 2011
INCOG

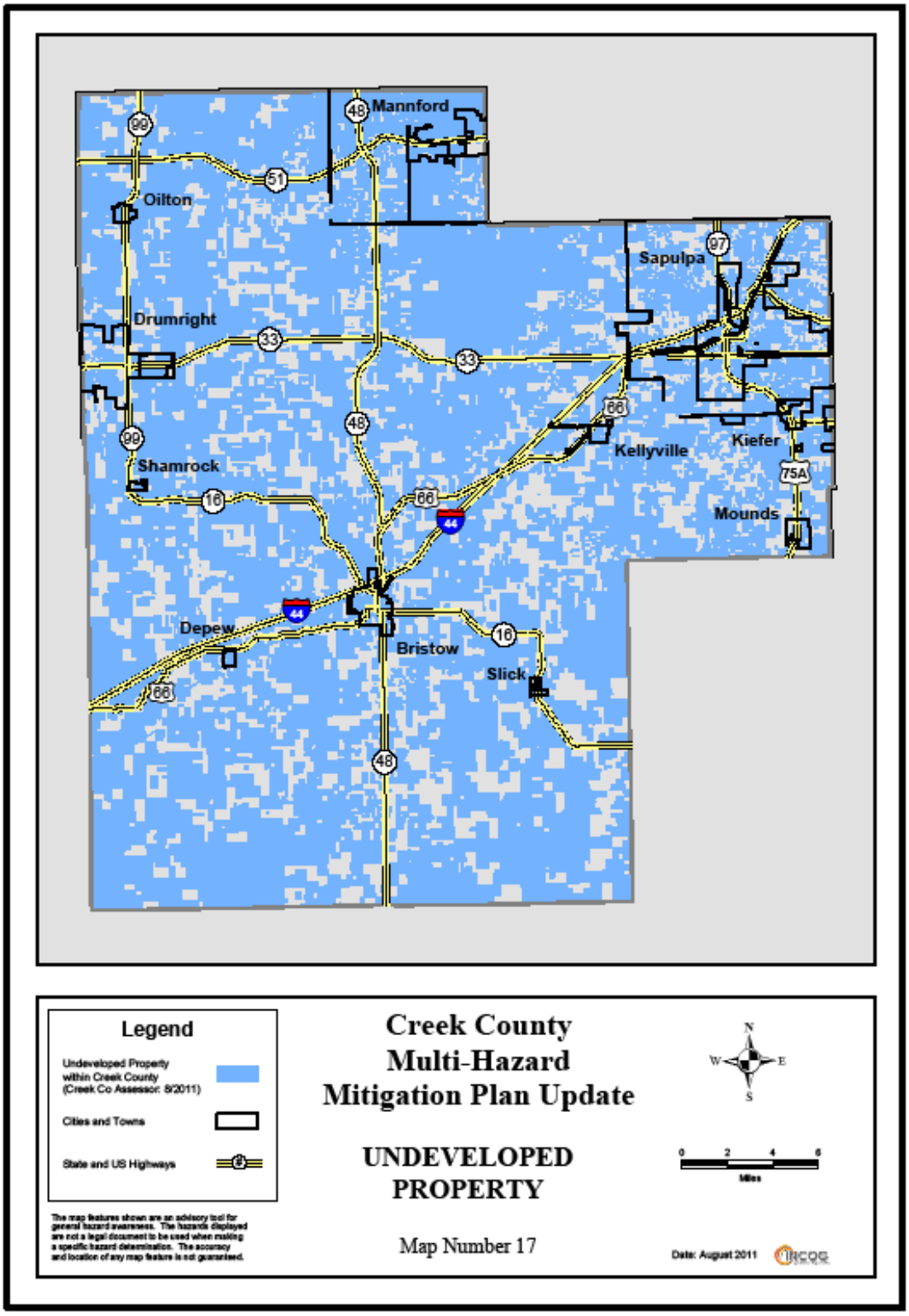

Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
99
48
51
97
33
66
16
75A
Legend
Regulatory Floodplain (FEMA)
Facilities:
Fire
City Govt
Hospital
Police
County Govt
Child Care
Elderly Care
School
Water/ Wastewater
Highways
Cities and Towns
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
CRITICAL FACILITIES
and
FLOOD HAZARDS
Map Number 12
N
W
E
S
0
2
4
6
Miles
Date: August 2011
INCOG


Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
99
48
51
97
33
66
75A
16
44
Legend
Historic Tornado Path
Approximate Damage Boundary
Critical Facilities
Cities and Towns
Highways
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
TORNADO
PATH
EXAMPLE
Map Number 13
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG


Mannford
Oilton
Drumright
Sapulpa
Shamrock
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
33
97
66
75A
16
44
Legend
Approximate Area of Inundation by Dam Break
Creek County Hazard Dams
Critical Facilities
Cities and Towns
Highways
Streets
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
DAM BREAK
HAZARD and
CRITICAL FACILITIES
Map Number 14
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG


Mannford
Oilton
Sapulpa
Drumright
Shamrock
Kellyville
Kiefer
Mounds
Depew
Bristow
Slick
99
48
51
97
33
66
16
44
75A
Legend
Major Transportation Routes
Railroads
Cities and Towns
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
MAJOR
TRANSPORTATION
ROUTES
Map Number 15
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG


Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
Legend
Major Transportation Routes
Railroads
Critical Facilities
Cities and Towns
Streets and Roads
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
MAJOR TRANSPORTATION ROUTES and CRITICAL FACILITIES
Map Number 16
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG


Mannford
Oilton
Sapulpa
Drumright
Kellyville
Kiefer
Shamrock
Mounds
Depew
Bristow
Slick
99
48
51
97
33
66
75A
16
44
Legend
Undeveloped Property within Creek County (Creek Co Assessor: 8/2011)
Cities and Towns
State and US Highways
The map features shown are an advisory tool for general hazard awareness. The hazards displayed are not a legal document to be used when making a specific hazard determination. The accuracy and location of any map feature is not guaranteed.
Creek County
Multi-Hazard
Mitigation Plan Update
UNDEVELOPED
PROPERTY
Map Number 17
N
W
E
S
0 2 4 6
Miles
Date: August 2011
INCOG

Appendix 2:

Committee Meetings

Meeting Notice
Creek County Multi-Jurisdictional Multi-Hazard Mitigation Plan Update Meeting

Creek County has received a grant from the Oklahoma Department of Emergency Management to update the Creek County multi-jurisdictional multi-hazard mitigation plan. The initial meeting in the planning process to update the Creek County multi-jurisdictional multi-hazard mitigation plan will be held November 17, 2011, at 10:00 am at the Collins Ball Room, Creek County Assessor Building, 317 E Lee, Sapulpa, OK. Topics planned to be discussed include the need for a multi-jurisdictional multi-hazard mitigation plan, the jurisdictions to be involved, establishment of a committee to facilitate the update of the Creek County multi-jurisdictional multi hazard mitigation plan, review of a draft of the first two chapters of the updated plan, "Introduction" and "The Planning Process", and a discussion of the hazards that OEM requires to be in the plan. All Creek County citizens are invited. Contacts for this update of the Creek County multi-jurisdictional multi-hazard mitigation plan can be made to Irving Prack, Creek County Planning at 918-227-6369 or to John McElhenney, INCOG at 918-584-7526.

Posted at: 317 E. Lee, Sapulpa, OK

Posted Date: 11-1-11

Posted by: [signature]

Creek County Hazard Mitigation Plan Update Meeting

Collins Ball Room
Creek County Assessor Building
317 E Lee
Sapulpa, OK

November 17, 2011
10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Discussion on the need to this multi-hazard mitigation plan.
4. Discussion on the involvement of the jurisdictions; Creek County, the communities, and the school districts.
5. Establishment of a committee to facilitate the update of the Multi-Jurisdictional Creek County Hazard Mitigation Plan, and select a chairman.
6. Review draft of Chapter 1, Introduction to the Plan. Gather general information on each jurisdiction for Chapter 1.
7. Review Chapter 2, The Planning Process. Discuss the hazards and prepare a general population hazard awareness survey and determine how to disseminate and collect the survey.
8. Summarize the information needed from each jurisdiction for Chapters 1 and 2.
9. Set date and time for next meeting.
10. Adjourn.

Meeting #1 Attendance

Name	Jurisdiction
Irving Frank	Creek County
Misty McCurley	Creek County
Jimmy Reynolds	Allen Bowden Schools
George Jones	City of Drumight
Roger Tuttle	Town of Kellyville
Rick Forbes	Creek County Health Dept
Joe Crowder	Drumright Schools
Roscoe Thornbury	Creek County
Janell Diehl	Creek County
Johnny Burke	Creek County
Johnny Brock	Sapulpa Herald
Alfred Gaches	Mounds Schools
Bob Grant	City of Bristow
John McElhenney	INCOG

Creek County Hazard Mitigation Plan Update Meeting
Collins Ballroom, Creek County Assessor Building
317 E Lee Street, Sapulpa, OK

Minutes of the November 17, 2011 Meeting

1. The meeting was called to order at 10:00 am.
2. General introductions were made around the room.
3. John McElhenney (JDM) discussed the need for the Creek County multi-hazard mitigation plan, to understand the hazards that could affect the County and the County jurisdictions, and also so the participating jurisdictions will be eligible for mitigation grant funds.
4. JDM explained why the many jurisdictions were participating in the County hazard plan update, to reap the benefit of having a plan (in this case, being a part of the County plan) and not have to have each jurisdiction prepare an individual plan.
5. The Creek County hazard mitigation planning committee was re-established as the jurisdictions represented, and named Roscoe Thornbury as Chairman of the committee.
6. JDM reviewed the draft of the update of Chapter 1 with the committee, and requested the jurisdictions to send information on their jurisdiction's building regulations and existing mitigation type plan (CIP and EOP for example) to the County Emergency Management staff.
7. JDM reviewed the draft of the update to Chapter 2 on the planning process with the committee. Questions arose on why specific hazards were and were not included in the plan. JDM answered that the hazards listed were the hazards that FEMA wanted addressed. JDM then discussed the need for a citizen hazard awareness survey. The committee accepted the draft survey form, and will distribute the survey forms at their jurisdiction's main office starting next week. The completed surveys will be collected on November 23, 2011, and sent to Mr. Thornbury at the County emergency management office to give to INCOG to compile and present the results at the next committee meeting.
8. JDM reiterated the information needed from each jurisdiction to complete chapters 1 and 2. The additional information was to be sent to JDM by the following week.
9. The next meeting of the Creek County hazard mitigation planning committee was set for Thursday, January 12, 2012, at 10 o-clock in the morning back here at the Creek County Assessor Building's Collins Ballroom.
10. The committee meeting was adjourned at 11:30 am.

Meeting Notice
Creek County Hazard Mitigation Plan Update Meeting

Creek County has received a grant from the Oklahoma Department of Emergency Management to update the Creek County Multi-Jurisdictional Multi-Hazard Mitigation Plan. The next meeting in the planning process to update the Creek County multi-jurisdictional multi hazard mitigation plan will be held on January 12, 2012, at 10:00 am at the Collins Ball Room, Creek County Assessor Building, 317 E Lee, Sapulpa, OK. Topics planned for discussion include reviewing the general hazard awareness survey, the plan's chapter on the County's risk and vulnerability to the hazards and the plan's chapter on mitigation strategies. All Creek County citizens are invited. Contacts for this update to the Creek County multi-jurisdictional Multi-Hazard Mitigation Plan can be made to Irving Frank, Creek County Planning at 918-227-6369 or to John McElhenney, INCOG at 918-584-7526.

Posted at: 3:30 pm

Posted Date: 1-3-12

Posted by: [signature]

Creek County Hazard Mitigation Plan Update Meeting

Collins Ball Room
Creek County Assessor Building
317 E Lee
Sapulpa, OK

January 12, 2012
10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Review and Approve minutes of November 17, 2011 committee meeting.
4. Discuss outstanding data to complete Chapter 1.
5. Present general population hazard awareness survey.
6. Review draft of Chapter 3, Risk and Vulnerability Analysis, including updating the list of critical facilities.
7. Review draft of Chapter 4, Mitigation Strategies.
   a. Discuss goals and objectives of the hazards' mitigation actions.
   b. Discuss mitigation activities. Identify activities for each jurisdiction.
8. Set date and time for next meeting.
9. Adjourn.

Meeting #2 Attendance

Name	Jurisdiction
Jimmy Reynolds	Allen Bowden Schools
Bob Grant	City of Bristow
George Jones	City of Drumright
Roscoe Thornbury	Creek County
Joe Crowder	Drumright Schools
John McElhenney	INCOG
Stacey White	Town of Kiefer
Curtis Shelton	Bristow Schools
Ike McDaniel	Mannford Schools
Newt Stephens	Creek County

Creek County Hazard Mitigation Plan Update Meeting
Collins Ballroom, Creek County Assessor Building
317 E Lee Street, Sapulpa, OK

Minutes of the January 12, 2012 Meeting

1. The meeting was called to order at 10:00 am.

2. General introductions were made around the room.
   John McElhenney (JDM) gave a brief overview of the need for the Creek County multi-hazard mitigation plan for the benefit of the new committee members present, to understand the hazards that could affect the County and the County jurisdictions, and also so the participating jurisdictions will be eligible for mitigation grant funds.

3. The minutes of the November 17, 2011 were approved as written.

4. JDM discussed the outstanding data needed for sections 1.3 and 1.4 of Chapter 1.

   JDM asked those jurisdictions with outstanding data to send the data to JDM right away.

5. The results of the general population hazard awareness survey were distributed. Tornados were the hazard of most concern and dam breaks were the hazard of least concern. Additional surveys were returned during this meeting and JDM will incorporate them into the final survey results.

6. The draft of Chapter 3, the risk and vulnerability analysis was distributed. JDM summarized the chapter, and specifically highlighted the list of critical facilities. Committee members offered additional facilities to be added to the list.

7. A draft of chapter 4, mitigation strategies, was distributed. JDM summarized the goals and objectives of mitigation strategies for each hazard. JDM then discussed the categories of mitigation activities, and examples of specific mitigation activities.

   JDM said the County is required to identify at least two mitigation activities per hazard to include in the plan. And each participating jurisdiction is required to identify at least four to five mitigation activities to be included in the plan.

   The list of mitigation activities was requested to be sent to JDM by January 27, 2012, so JDM will enter them into Chapter 5, the action plan.

8. The next meeting of the Creek County hazard mitigation planning committee was set for Thursday, February 16, 2012, at 10 o-clock in the morning back here at the Creek County Assessor Building's Collins Ballroom.

9. The committee meeting was adjourned at 11:15 am.

Meeting #3 Notice
(Meeting Date: February 16, 2012)

Meeting Notice
Creek County Hazard Mitigation Plan Update Meeting

Creek County has received a grant from the Oklahoma Department of Emergency Management to update the Creek County Multi jurisdictional Multi Hazard Mitigation Plan. The next meeting in the planning process to update the Creek County Multi Jurisdictional Multi-Hazard Mitigation Plan will be held February 16, 2012, at 10:00 am at the Collins Ballroom, Creek County Assessor Building, 317 E. Lee, Sapulpa, OK. Topics planned for discussion will include the mitigation activities proposed by the jurisdictions for inclusion in the updated plan, and the requirements for adopting the updated plan by each participating jurisdiction. All Creek County citizens are invited. Contacts for this update to the Creek County Multi-Jurisdictional Multi Hazard Mitigation Plan can be made to Roscoe Thornbury, Creek County Emergency Management at 918 227-6358 or to John McElhenney, INCOG at 918 584 7526.

Posted Location: 317 E Lee Sapulpa

Posted Date: 2/10/12

Posted by:

Creek County Hazard Mitigation Plan Update Meeting

Collins Ball Room
Creek County Assessor Building
317 E Lee
Sapulpa, OK

Thursday February 16, 2012
10:00 am

Meeting Agenda

1. Call to order.
2. Introductions.
3. Review and Approve minutes of January 12, 2012 committee meeting.
4. Review of draft of Chapter 5; Action Plan of Mitigation Projects. Discuss any outstanding data needed to complete Chapter 5.
5. Review of draft of Chapter 6; Plan Maintenance and Adoption.
6. Develop a request for comments on the final draft of the plan update letter.
7. Set date and time for next meeting.
8. Adjourn.

Meeting #3 Attendance

Name	Jurisdiction
Bob Grant	City of Bristow
Irving Frank	Creek County
Misty McCurley	Creek County
Roscoe Thornbury	Creek County
Joe Crowder	Drumright Schools
John McElhenney	INCOG
Curtis Shelton	Bristow Schools
Newt Stephens	Creek County

Creek County Hazard Mitigation Plan Update Meeting
Collins Ball Room
Creek County Assessor Building
317 E Lee
Sapulpa, OK

Minutes of February 16, 2012 Meeting

1. The meeting was called to order by John McElhenney (JDM) at 10:00 am.
2. JDM made general introductions.
3. Minutes of the January 12, 2012 committee meeting was approved as written.
4. JDM reviewed the draft of Chapter 5 of the draft plan update, "The Action Plan". JDM gave an overview of the type of mitigation activities each jurisdiction submitted. Each jurisdiction attending this meeting had submitted mitigation activities. A question was raised if a jurisdiction could change or add to their mitigation activities before the final draft was finished. JDM said they could, so get any changes to JDM by next week, February 24, 2012. Review of draft of Chapter 5; Action Plan of Mitigation Projects. Discuss any outstanding data needed to complete Chapter 5.
5. JDM then reviewed the draft Chapter 6 of the draft plan update, "Plan Maintenance and Adoption". JDM explained that Creek County, not INCOG, must monitor, evaluate, and update the plan as described in this chapter. And the County will be required to incorporate mitigation actions into other County plans. And the County will be required to continue to involve the public in maintaining and updating the plan.
6. The committee reviewed the draft letter to solicit comments from state agencies and neighboring communities on the final draft plan, and recommended the letter to be sent as presented.
7. The next meeting will hold a public hearing on the final draft of the plan, receive comments on the final draft plan, explain the plan adoption procedure, and have the committee take action on the final draft of te plan update. The next meeting was set for March 29, 2012, at 10:00 am back here at the Creek County Assessor Building.
8. The meeting was adjourned at 11:00 am..

Meeting Notice
Creek County Hazard Mitigation Plan Update Meeting

Creek County has received a grant from the Oklahoma Department of Emergency Management to update the Creek County Multi-Jurisdictional Multi-Hazard Mitigation Plan. The next meeting in the planning process to update the Creek County multi-jurisdictional multi-hazard mitigation plan will be held March 29, 2012, at 10:00 am at the Creek County Assessor Building, 317 E. Lee St, Sapulpa, OK. Topics planned for the meeting include holding a public hearing on the draft plan, receiving comments from neighboring jurisdictions and agencies, discussion on recommending approval of the draft plan to the participating jurisdictions. All Creek County citizens are invited. Contacts for this update to the Creek County multi-jurisdictional Multi-Hazard Mitigation Plan can be made to Roscoe Thornbury, Creek County Emergency Management at 918-227-6358 or to John McElhenney, INCOG at 918-584-7526.

Posted at: _____

Posted Date: _____

Posted by: _____

Creek County Hazard Mitigation Plan Update Meeting

Collins Ball Room
Creek County Assessor Building
317 E Lee
Sapulpa, OK

March 29, 2012
10:00 am

1. Call to order.
2. Introductions.
3. Discussion and approval of October 26, 2011 meeting minutes.
4. Hold Public Hearing on final draft plan.
5. Receive comments from agencies and neighboring communities.
6. Discuss any outstanding items from the jurisdictions.
7. General discussion on the entire draft plan.
8. Discussion and action to recommend approval of the update to the Osage County multi-hazard mitigation plan to the participating jurisdictions.
9. Discussion on having each jurisdiction adopt the updated plan by resolution.
10. Set date and time for next meeting, if needed.
11. Adjourn.

Meeting #4 Attendance

Meeting #4 Minutes

Appendix 3:

Sample Comment Letter

February 27, 2012

Richard Brierre
Executive Director
INCOG
2 W Second St, Ste #800
Tulsa, OK 74103

Dear Mr. Brierre,

The Federal Emergency Management Agency through the Oklahoma Department of Emergency Management has awarded Creek County an HMGP grant (FEMA 1876-DR-OK –05) to update the County's Multi-Hazard Mitigation Plan.

Creek County was responsible for overseeing the initial Multi-Hazard Mitigation Plan and in undertaking the update process. The County formed a committee of the participation jurisdictions to participate in this update. The committee has met several times and has developed a draft of the updated plan. A copy of this draft document is available on the INCOG web site at www.incog.org/Community_Economic_Development/commdev_hazard_mitigation.html. As such, the County is inviting you to provide input and offer suggestions on the plan update.

Your comments are requested to be delivered, either written or verbal, to myself by 5 pm on March 15, 2012. The committee plans to meet March 29, 2012 at 10:00 am at the Creek County Assessor Office, 317 E Lee St, Sapulpa, OK, to review all comments and take action on a recommendation of the Updated Creek County Multi-Hazard Mitigation Plan to the Creek County Board of Commissioners.

County or INCOG staff may be contacting you directly as the planning update process is completed. If you have any questions, please contact me at (918) 227-6958, or John McElhenney, INCOG, at (918) 584-7526.

Sincerely,

Roscoe Thornbury
Director, Creek County Emergency Management

Appendix 4: Questionnaire

HAZARD MITIGATION SURVEY

Creek County is in the process updating the County Multi-Hazard Mitigation Plan. This will be strategic planning guide to reduce the county's impact from natural hazards and hazardous materials, in fulfillment of the Hazard Mitigation Grant Program requirements of the FEMA. This survey is intended to understand the citizen's awareness and concern of hazards that could impact Creek County.

For the following hazards, please circle the corresponding number indicating how concerned you are about these hazards affecting Creek County.

HAZARD	Very Concerned	Concerned	Somewhat Concerned	Not Concerned
Dam Breaks	**4**	**3**	**2**	**1**
Drought	**4**	**3**	**2**	**1**
Earthquakes	**4**	**3**	**2**	**1**
Expansive Soils	**4**	**3**	**2**	**1**
Extreme Heat	**4**	**3**	**2**	**1**
Floods	**4**	**3**	**2**	**1**
Hailstorms	**4**	**3**	**2**	**1**
Hazardous Materials Events	**4**	**3**	**2**	**1**
High Winds	**4**	**3**	**2**	**1**
Lightning	**4**	**3**	**2**	**1**
Severe Winter Storms	**4**	**3**	**2**	**1**
Tornadoes	**4**	**3**	**2**	**1**
Wildfires	**4**	**3**	**2**	**1**
Other Hazard: _____	**4**	**3**	**2**	**1**
Other Hazard: _____	**4**	**3**	**2**	**1**

Last day of survey is November 23, 2011.

If you have any comments, suggestions, or additional concerns, please note them on the back of this survey.

Survey Results

Hazard	Average Survey Score
Dam Break	1.5
Drought	2.9
Earthquakes	2.5
Expansive Soils	1.8
Extreme Heat	3.0
Floods	2.1
Hailstorms	2.5
Haz Mat Events	2.3
High Winds	2.6
Lightning	2.4
Severe Winter Storms	3.0
Tornados	3.2
Wildfires	3.1

Scoring:

Not concerned = 1 point (minimum score per hazard)
Somewhat concerned = 2 points
Concerned = 3 points
Very concerned = 4 points (maximum score per hazard)

Results:

104 Responses
Hazard of Most Concern is Tornados
Hazard of Least Concern is Dam Breaks

Appendix 5:

Plan Adoption Resolutions

Appendix 6:

Hazard Summary

Natural Hazard Assessments

Each hazard is assigned a likelihood rating based on the criteria and methods described below.

Likelihood of Event "Rating" is based on the following definitions	
Highly likely (HL)	Event is probable within the calendar year.
Likely (L)	Event is probable within the next three years.
Occasional (O)	Event is probable within the next five years.
Unlikely (UL)	Event is possible within the next ten years.

Based on History, and using the information described above, Likelihood of Event is "Quantified" as follows:		
Highly Likely (HL)	Event has 1 in 1 year chance of occurring	1/1 = 100%
Likely (L)	Event has 1 in 3 years chance of occurring	1/3 = 33%
Occasional (O)	Event has 1 in 5 years chance of occurring	1/5 = 20%
Unlikely (UL)	Event has 1 in 10 years chance of occurring	1/10 = 10%

Which results in the following "Ranges" of Likelihood:
Event is "Highly Likely" to occur – History of events is greater than 33%.
Event is "Likely" to occur – History of events is greater than 20%, but less than or equal to 33%.
Event could "Occasionally" occur – History of events is greater than 10%, but less than or equal to 20%.
Event is "Unlikely," but is possible of occurring – History of events is less than 10%.

Example: NWS-NCDC records show that 38 tornadoes were reported in Example County between 01/01/1950 and 12/31/2003. 38 events divided by 53 years = 0.72(72%) which would make future occurrences "Highly Likely" to happen.

This table's format, categories, and the criteria for completing the table, was supplied by the Oklahoma Department of Emergency Management, 06/29/2004.

Table: Creek County Hazard Summary

Summary of Hazards for the Creek County Multi-Hazard Mitigation Plan

Hazard Event	History	Estimated Total Dollar Loss ($$)	Average Cost Per Event ($$)	Likelihood Percentage	Likelihood Rating
Floods	78 events from 1950 thru 2010	10,780,000	138,205	78/60<100%	HL
Tornado	61 events from 1950 thru 2010	51,933,000	851,361	61/61=100%	HL
High Wind	287 events from 1950 thru 2010	1,916,000	6,676	287/61>100%	HL
Lightning/Thunderstorm	5 events from 1950 thru 2010	268,000	53,600	5/61=8%	UL
Hailstorms	207 events from 1950 thru 2010	365,000	1,763	207/61>100%	HL
Winter Storms	30 events from 1950 thru 2010	50,155,000	1,671,833	30/61=49%	HL
Extreme Heat	10 events from 1950 thru 2010	0	0	10/61=16%	O
Drought	11 events from 1950 thru 2010	0	0	11/61=18%	O
Expansive Soils	zero events from 1950 thru 2010	0	0	0%	UL
Wildfire	events from 1950 thru 2010			>100%	HL
Earthquake	zero events from 1950 thru 2010	0	0	0%	UL
Hazmat Events	events from 1950 thru 2010			>100%	HL
Dam Failure	zero events from 1950 thru 2010	0	0	0%	UL

Note: where zero events or zero dollar amounts are shown, this means there was no data reported for the hazard event.